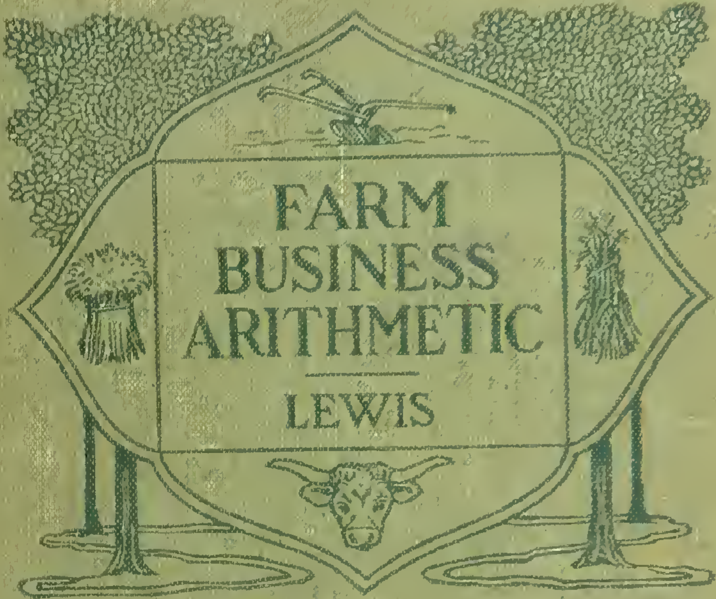

FARM BUSINESS ARITHMETIC

LEWIS

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State College of Agriculture
At Cornell University
Ithaca, N. Y.

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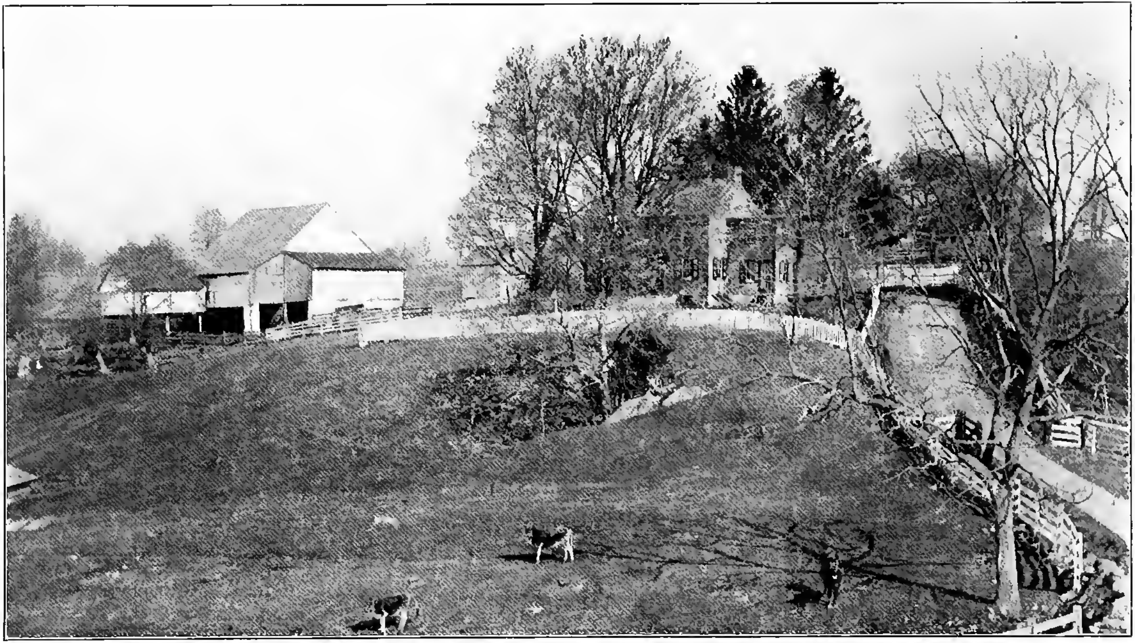
FARM-BUSINESS ARITHMETIC

"I believe in the farm boy
and in the farm girl."



The Home on the Farm

FARM-BUSINESS ARITHMETIC

BY

CURTIS J. LEWIS, B.A.

GOOD FARMING:
One-fifth better than the average crop production
One-half better than the average cow production

D. C. HEATH & COMPANY, PUBLISHERS
BOSTON NEW YORK CHICAGO

LEWIS'S ARITHMETICS

Primary Arithmetic

A complete course in the essentials of arithmetic. 252 pages.

Farm-Business Arithmetic

A book filled with modern data on successful farming; teaches farm accounting and the application of business methods to rural life. 212 pages.

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1 L 5

THE COUNTRY BOY'S CREED

I BELIEVE that the Country, which God made, is more beautiful than the City, which man made; that life out-of-doors and in touch with the earth is the natural life of a man. I believe that work is work wherever we find it, but that work with Nature is more inspiring than work with the most intricate machinery. I believe that the dignity of labor depends not on what you do, but on how you do it; that opportunity comes to a boy on the farm as often as to the boy in the city; that life is larger and freer and happier on the farm than in the town; that my success depends not upon my location, but upon myself — not upon my dreams, but upon what I actually do — not upon luck, but upon pluck. I believe in working when you work, and in playing when you play, and in giving and demanding a square deal in every act of life.

EDWIN OSGOOD GROVER.

PREFACE

Make the work of the school the talk of the home.

It has been found that the back-to-the-land movement and the general awakening to the significance of agriculture have occasioned a universal demand for more farm arithmetic and more teaching of real, live, practical problems, relating to the operations of farm life.

With this observation this book of farm problems has been prepared, and may be used as a course of daily lessons, or as supplementary arithmetic work. While it may be used to supplement the general principles of arithmetic, its main purpose is to illustrate the principles of farm problems and the possibilities of the farm, and to foster a predilection in our young people for farm life. Many subjects are such as can be mastered by pupils ranging from twelve to fifteen years old, thus catching the interest of these boys and girls before that interest becomes settled elsewhere.

An office man, in looking over the manuscript for this book, remarked, "If I had been taught this kind of thing when I went to school, I might have stayed on the farm."

The problems are generally type problems, each to be extended and repeated with local values and conditions, at the discretion of the teacher, until thoroughly understood by her classes.

The epigrams at the beginning of the subjects may be made to serve a useful purpose when thoroughly impressed by the teacher. For instance, " Pay as you go," an old saying, yet new to the child, may be made to save many a future man and many a future woman from financial shipwreck.

Realizing the importance of the farmers' experience in a work of this kind, a large majority of the problems have been taken from actual conditions — simple and direct, and within the range of everyday farm experience. While they may have some local color, depending on the region in which the author lives, the nature and principles of the problems will be found applicable everywhere.

Let our boys and girls be trained, not only to think, but how to work, and to honor labor. Let the school cease to be a means of rising above hard work. " Try to get an education, so you won't have to work as hard as we do," is the advice with which parents for the past twenty-five years or so have been prone to start their children out to school. The ill effects of such advice is being visited upon our country to-day, for too many of our boys and girls have been educated away from the farm entirely.

The teacher who is instilling into her boys and girls a love for home, for the country, and the farm; and is leading them to become honorable men and women, is doing more for the future good of her country than those of any other profession. The president of a large and influential college recently said: " I hope to see the day when textbooks for rural schools will point the country-bred student to the farm and country life as directly and forcefully as they now lead to the counting room and the city."

The author wishes to acknowledge the great helpfulness and encouraging comments that have been extended by the following general reviewers of the manuscript for this book: Thos. I. Mairs, Professor of Agricultural Education, State College, Pa.; Dr. L. H. Bailey, author of *Cyclopædia of American Agriculture*, Ithaca, New York; Prof. Charles F. Schlatter, South Dakota State College; Prof. L. H. Dennis, Specialist in Agricultural Education, Harrisburg, Pa.; and Prof. Arthur Cromwell, Teacher of Agriculture, West Chester State Normal School, Pa.; also to G. F. Warren, author of *Farm Management*, Ithaca, N. Y., who reviewed problems in "Farm Management"; Prof. W. A. Henry, Madison, Wis., author of *Feeds and Feeding*, who reviewed "Dairy Feeding"; Clarence B. Lane, B.S., of Philadelphia, Pa., who reviewed "Dairy Problems"; and Thos. M. Knight, editor of *The Practical Farmer*, Philadelphia, Pa., who reviewed "Fertilizers"; and others.

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FARM-BUSINESS ARITHMETIC

FARM ACCOUNTING

"Most of the disputes about accounts are because some one forgets, rather than because of dishonesty."

THE average farmer, whose time is largely devoted to farm work, realizes that it is neither practical nor profitable to keep a detailed system of cost accounting, and yet, a simple record of daily business transactions will prove a satisfaction to him in estimating general results, and as a basis for future comparison.

In order to have a complete set of farm accounts, three records are necessary:

1. An inventory at the beginning and at the end of the year.
2. An account of all money paid out or received.
3. A record of all work done by men and horses during the year.

The Inventory

The most important record on a farm is the inventory, which is mainly a list of farm property.

The making of an inventory will give every boy an understanding of the real and personal property on his father's farm, and its value. "The pride of property appeals strongly to a boy, and the sense of proprietorship is a strong tie to bind him to the farm."

In filling out the form given below, figure the quantity of grain, hay, etc., by rules found in this book, and estimate their value at prevailing farm prices. Farm machinery and vehicles should be estimated on a yearly depreciation of ten per cent from their original cost.

INVENTORY

Of ------------------------------------ *Farm*

Date ------------------------

[In estimating values, let the market price on the farm, or the price at the selling place minus the cost of hauling to market, be the standard.]

----------- acres of land @	$------------------
----------- head of cows @	------------------
----------- head of other cattle @	------------------
----------- head of horses @	------------------
----------- head of hogs @	------------------
Poultry	------------------
Farm Machinery	------------------
Vehicles	------------------
Harness	------------------
Hay ----------- tons @	------------------
Corn ------------- bushels @	------------------
Wheat ------------- bushels @	------------------
Oats -------------- bushels @	------------------
Potatoes ----------- bushels @	------------------
Apples ------------ bushels @	------------------
Other Products	------------------
Household Furniture	------------------
TOTAL	$------------------

Cash Account

Perhaps the method of farm bookkeeping most useful to farmers is the cash account, by which all items for which money is received, as stock, crops, and other products, are entered on the left page under "Receipts" and all items for which money is expended are placed on the right page under "Expenditures."

RECEIPTS

1915

April 2	*15 bu. potatoes*	*@*	*$ .80*	*$ 12.00*	
“ 2	*12 doz. eggs*	*@*	*.25*	*3.00*	
“ 5	*3 tons hay*	*@*	*22.00*	*66.00*	
“ 7	*1 cow, to George Pierce*			*65.00*	*$ 146.00*

EXPENDITURES

1915

April 3	*1 ton wheat bran*	*$ 24.00*	
“ 3	*Repairing wagon*	*7.50*	
“ 5	*Dairy expenses*	*3.70*	
“ 5	*Garden seeds*	*6.00*	
“ 7	*Personal*	*3.25*	*$ 44.45*

Such a record, if followed to the end of the year, will give all the business transactions, but does not classify them. But the returns from each enterprise, as poultry or dairy, may be ascertained by classifying all records under their respective headings.

Second Method

Or, to make the original entry direct upon its own account is a second method of handling the cash transactions; that is, instead of putting all the different items down one after another on one page, to classify them as they are entered in the book; thus,

Dairy

Receipts

1915

April 5	*2 cows to Miff Hickman*	*$ 140.00*	
" 7	*1 yearling to Wayne*	*23.00*	
" 15	*Milk and Cream*	*108.00*	*$ 271.00*

Expenditures

1915

April 4	*1 ton bran*	*$ 22.00*	
" 5	*2 milk pails*	*1.50*	
" 6	*1 cow from S. Bane*	*67.00*	
" 6	*½ ton cottonseed meal*	*15.50*	*$ 106.00*

See corn account, on page 22, as an illustration of the second method.

Examples

Enter the following according to the first method:

April 4, sold 12 bushels apples, @ $.80; April 5th, paid help, $20.00; April 8th, bought set harness, $22.00; April 8th, bought binder, $125.00; April 10th, sold calf, $11.22; April 11th, dairy expenses, $7.54; April 13th, sold 3 tons hay, at $18.00; April 15th, sold 14 dozen eggs, @ $.26; April 16th, bought 2½ bushels seed potatoes, at $1.25; April 20th, received milk check, $80.45.

A *work record* account contains simply a record of the work done on the farm during the year, classified according to the enterprise for which it was done. It also gives the date and number of hours of each operation.

A SAMPLE WORK RECORD WITH WHEAT

1915		MAN		HORSE	
		Hours	Minutes	Hours	Minutes
Aug. 3	*Plowing oats stubble*	*8*	*30*	*17*	
	Rolling	*1*	*45*	*3*	*30*

Horse hours are expressed in terms of one horse for one hour; thus, 2 horses for 8½ hours is expressed as 1 horse for 17 hours.

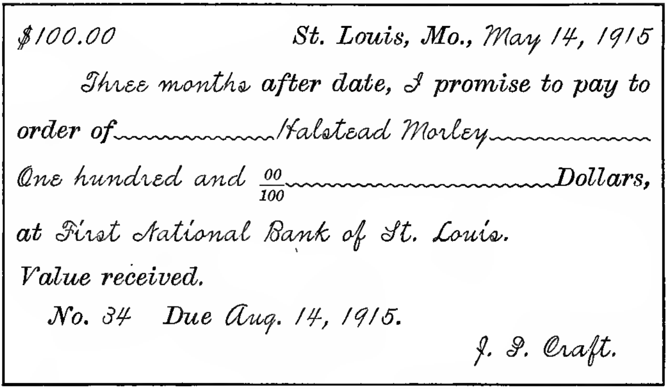
A SAMPLE CHORE RECORD

1915	HORSES		COWS		POULTRY		HOGS	
	Hours	Minutes	Hours	Minutes	Hours	Minutes	Hours	Minutes
May 1	*2*	*20*	*4*	*15*	—	*30*	*1*	*10*
" *2*								
" *3*								
" *4*								
etc.								

If chore time is fairly uniform each day, an entry at the beginning, at the middle, and at the end of each month will ordinarily be sufficient.

FARM–BUSINESS PAPERS

"Never sign a paper without first carefully reading it."



$100.00 St. Louis, Mo., May 14, 1915

Three months after date, I promise to pay to

order of Halstead Morley

One hundred and 00/100 Dollars,

at First National Bank of St. Louis.

Value received.

No. 34 Due Aug. 14, 1915.

J. P. Craft.

Promissory Note

By this written promise, given by J. P. Craft to Halstead Morley, J. P. Craft promises to pay $100 to Halstead Morley three months after date of the note, which will be August 14, 1915.

Discounting Notes

If Mr. Morley wishes to use some money before August 14, he may take Mr. Craft's note to bank, say on June 5, and get it discounted. That is, he gets $100 minus the interest of $100 for the time between June 5 and August 14. On August 14 the $100 is paid to the bank by Mr. Craft.

No. 342 West Chester, Pa., May 4, 1915

FIRST NATIONAL BANK

Pay to Isaac Webb or order $345.00

Three hundred forty-five $\frac{00}{100}$ *Dollars.*

Harry Wayne.

CHECK

It is supposed that Harry Wayne has at least $345 deposited in the First National Bank of West Chester. He owes Isaac Webb $345, for which sum he writes out this check and gives it to Mr. Webb, who takes it to the bank and gets $345 of Mr. Wayne's deposit.

QUESTION. — Could Isaac Webb get this check cashed at the bank if Harry Wayne had less than $345 deposited there?

What is meant by overdrawing your bank account?

$67.50 Ironton, Ohio, April 7, 1915

Received of Lervy Hayward sixty-seven and $\frac{50}{100}$ *dollars for three tons of phosphate at $22*$\frac{50}{100}$ *per ton.*

Wilton Ashbridge.

RECEIPT

This receipt, held by Lervy Hayward, shows that he has paid the amount named therein to Mr. Ashbridge.

Question.— Suppose Wilton Ashbridge should attempt to collect this $67.50 again? Should you always get a receipt for money paid? Why should you take care of your receipts? Of what use is a canceled check?

> *Hamorton, Pa., July 7, 1915*
>
> *P. M. Pyle.*
>
> *Please deliver to Jacob Brown goods from your store amounting to twelve dollars ($12.00), and charge to my account.*
>
> *Lewis Harry.*

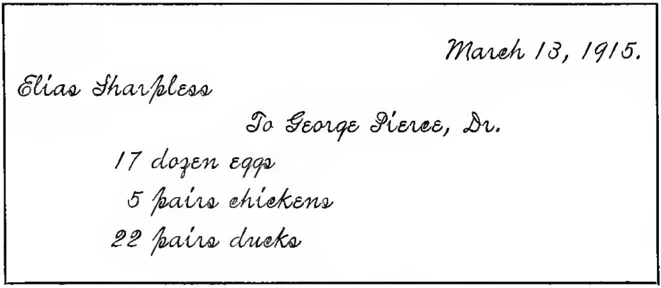
Order for Goods

Lewis Harry, who owes Jacob Brown twelve dollars, gives this order to Mr. Brown, who takes it to Mr. Pyle's store and gets twelve dollars' worth of goods with it. Mr. Harry then pays Mr. Pyle.

> *$7.75* *Wayne, Mich., Aug. 3, 1915.*
>
> *Due Casper Norton, seven and $\frac{75}{100}$ dollars in merchandise from my store.*
>
> *Medill Ashton.*

Due Bill

Medill Ashton writes this bill and gives it to Casper Norton; it entitles Mr. Norton to goods worth $7.75 from Mr. Ashton's store at any time.



March 13, 1915.

Elias Sharpless

To George Pierce, Dr.

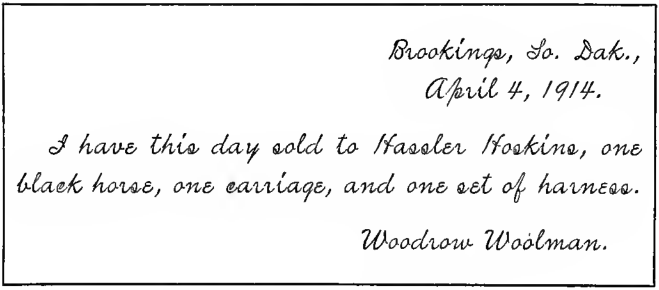
17 dozen eggs

5 pairs chickens

22 pairs ducks

MEMORANDUM BILL

This bill, given to Elias Sharpless, commission merchant, by George Pierce, shows that these goods have been delivered to Mr. Sharpless for sale.



Brookings, So. Dak.,
April 4, 1914.

I have this day sold to Hassler Hoskins, one black horse, one carriage, and one set of harness.

Woodrow Woolman.

SHORT FORM OF BILL OF SALE

This bill of sale is an agreement in writing, given by Woodrow Woolman to Hassler Hoskins, by which Mr. Woolman transfers his interest in the within named personal property to Mr. Hoskins.

FARM ARITHMETIC WITHOUT A PENCIL[1]

The live farmer does not have to hunt up a paper and pencil every time he needs to do a little calculating or "figuring."

1. When bran is selling at $25.00 per ton, what is the cost of 100 pounds?

2. What is the value of cottonseed meal per hundred when selling at $33.00 per ton?

3. What is the value of corn meal per ton when selling at $1.50 per 100 pounds?

How does the operation of this problem compare with that of problem 1?

4. At 85¢ per hundredweight, what is the cost of hay per ton?

Find the cost of:

5. 40 bushels of corn at 60 cents per bushel.

6. 30 bushels of wheat at $1.10 per bushel.

7. 200 baskets of potatoes at 50 cents per basket.

8. 40 baskets of Kieffer pears at 30 cents per basket.

---

[1] Directions to the Teacher. — Lead the pupils to be "ready reckoners" without a pencil in such problems as these. The teacher will realize that these are mostly type problems, each to be repeated with different values and often with different wording until the principle is thoroughly understood. It might be well to give a little such oral work almost daily, thus keeping the class thoroughly livened up. Let thoroughness be the watchword in the preparation of the successful farmer.

9. 1 crate of eggs (30 dozen) at 25 cents per dozen.

10. 2½ days' work at $1.50 per day.

11. 12 yards of carpet at $1.50 per yard.

12. Shades for 14 windows at 60 cents each.

13. If you buy 10 pounds of sugar at 5½ cents a pound, how much change should you receive out of a dollar?

14. What is the value of the hay produced on a 20-acre field, if it averages $17 per acre?

15. What is the weight of 12 quarts of milk at 2⅛ pounds per quart?

16. What is the shrinkage of a crib of corn for the month of November, if it contains 300 bushels and the rate of shrinkage is 5%?

17. An auctioneer charges 1 per cent for selling $1000 worth of goods. What is his commission?

18. It is computed that the average cost of living for one person a year in the United States is $183. What is the cost for a family of 4 persons at this rate?

19. How many hours from 10 o'clock A.M. to 4:30 P.M.?

20. How many plants can you buy for a dime at ¼ a cent each?

21. If you raise potatoes for 30 cents a bushel and sell them at 40 cents a bushel, what is your rate of profit?

22. What is the interest on $150 for 2 years at 5%? On $60 for 4 months at 6%?

23. When the entire cost of a cow's keep for a year is $80, the feed and pasture cost $\frac{5}{8}$ of this amount, the labor $\frac{5}{16}$ and other incidentals $\frac{1}{16}$ of it. Find each cost.

24. What will a $120 binder cost at 5% off for cash? At 10% off?

25. When bran is retailing at $22 per ton, a farmer gets it at wholesale at $20 per ton. What per cent does he save?

26. What should you ask for a basket of potatoes that is $\frac{3}{4}$ full when they are selling at 60 cents a basket?

27. When a man plows $\frac{3}{5}$ of a field in a week, how long will it take to plow the remainder?

28. If your father borrows $200 for three months, at 5% interest, how much does he owe at the expiration of that time?

29. If it cost 55 cents to raise a bushel of wheat, and you sell it for 66 cents, what per cent are you making on your investment?

30. When there is a special sale of clothing at "$12\frac{1}{2}$ per cent off," what would you have to pay for a suit marked $16?

PERCENTAGE ON THE FARM[1]

"Every good farmer I ever knew was good in arithmetic."

Per cent means by the hundred; thus, $\frac{5}{100}$ or .05 may be expressed as 5 per cent (5%), which means 5 of every hundred. Since per cent may be expressed either as a common fraction or a decimal, 4%, $\frac{4}{100}$, and .04 all mean the same thing.

Table of Common Per Cents

$50\% = .50 = \frac{50}{100}$ or $\frac{1}{2}$
$33\frac{1}{3}\% = .33\frac{1}{3} = \frac{33\frac{1}{3}}{100}$ or $\frac{1}{3}$
$66\frac{2}{3}\% = .66\frac{2}{3} = \frac{66\frac{2}{3}}{100}$ or $\frac{2}{3}$
$25\% = .25 = \frac{25}{100}$ or $\frac{1}{4}$
$75\% = .75 = \frac{75}{100}$ or $\frac{3}{4}$
$20\% = .20 = \frac{20}{100}$ or $\frac{1}{5}$
$40\% = .40 = \frac{40}{100}$ or $\frac{2}{5}$
$60\% = .60 = \frac{60}{100}$ or $\frac{3}{5}$
$80\% = .80 = \frac{80}{100}$ or $\frac{4}{5}$
$16\frac{2}{3}\% = .16\frac{2}{3} = \frac{16\frac{2}{3}}{100}$ or $\frac{1}{6}$
$83\frac{1}{3}\% = .83\frac{1}{3} = \frac{83\frac{1}{3}}{100}$ or $\frac{5}{6}$
$12\frac{1}{2}\% = .12\frac{1}{2} = \frac{12\frac{1}{2}}{100}$ or $\frac{1}{8}$
$37\frac{1}{2}\% = .37\frac{1}{2} = \frac{37\frac{1}{2}}{100}$ or $\frac{3}{8}$

---

[1] Direction to the Teacher. — A more general use of percentage is constantly coming into the business part of farm life. Time will be economized in making pupils proficient in these type problems and many similar ones before attempting the work of this book.

Table of Common Per Cents — *Continued*

$62\frac{1}{2}\% = .62\frac{1}{2} = \frac{62\frac{1}{2}}{100}$ or $\frac{5}{8}$

$87\frac{1}{2}\% = .87\frac{1}{2} = \frac{87\frac{1}{2}}{100}$ or $\frac{7}{8}$

$10\% = .10 = \frac{10}{100}$ or $\frac{1}{10}$

$8\frac{1}{3}\% = .08\frac{1}{3} = \frac{8\frac{1}{3}}{100}$ or $\frac{1}{12}$

$6\frac{1}{4}\% = .06\frac{1}{4} = \frac{6\frac{1}{4}}{100}$ or $\frac{1}{16}$

$5\% = .05 = \frac{5}{100}$ or $\frac{1}{20}$

$4\% = .04 = \frac{4}{100}$ or $\frac{1}{25}$

Any number of per cent may be written decimally by omitting the sign, %, and placing a decimal point two places from the right, prefixing a cipher, if necessary. Thus,

1% = .01
10% = .10
12% = .12
3.8% = .038
4.21% = .0421
12.3% = .123
$5\frac{1}{2}\% = .05\frac{1}{2}$
.8% = .008

Any decimal may be written as per cent by placing the decimal point two places to the right and writing the per cent sign. Thus,

.02 = 2%
.15 = 15%
.025 = 2.5%
.0125 = 1.25%
.005 = .5%
.0025 = .25%
1 = 1.00 = 100%
3 = 3.00 = 300%

Examples

Write decimally:

5%
8%
15%
1.5%
20%
50%
100%
125%
.1%
.01%
25%
2.5%

Write as per cent:

.03
.12
.28
.028
1.00
1.35
2.5
2
4
7
.006
.1250
.315
.4125

Oral Problems

1. What does 6% mean? 10%? 25%? 2%?

2. If 4 (6, 12, 20) chickens out of every hundred die, what per cent of the chickens die?

3. If 2 (5, 10, 25)% of a flock of chickens die, how many out of every hundred die?

4. If 2 (4, 6, 30)% of 50 chickens die, how many chickens die?

QUESTION. — Could 3% of 50 chickens die? What per cent would die if they all died?

5. What is 25% of 80?

6. 80 is 25% (¼) of what number?

7. What is 40 per cent of 20 (25, 40, 125)?

8. 20 (24, 40, 100) is 40 per cent of what number?

9. If my money is 10 (25, 50, 100, 40) per cent of yours, your money is how many times mine?

10. If my money is ½ (¼, ⅓, ⅕, ⅛) of yours, it is what per cent of yours? Your money is how many times mine? How many per cent of mine?

11. If an article sells for 2 times what it cost, what per cent represents the selling price? What per cent represents the gain?

The cost is always 100 per cent of itself.

12. If an article sells for 400 (500, 50, 75, 600) per cent of the cost, it sells for how many times the cost?

What per cent represents the gain or loss in each case?

13. When 1 bushel of seed produces 10 (25, 30) bushels of crop, the crop is what per cent of the seed? What per cent of the seed is cleared?

Written Problems

1. School was open 20 days in April, and the percentage of attendance marked on your report for April is 75. How many days did you attend this month?

Question.— Could you have over 100 in percentage of attendance?

2. A farmer's cow gave 5845 pounds of milk in August, and it tested 3.42% butter fat. What was the amount of butter fat?

3. During her milking season of 300 days, a cow gave 6003 pounds of milk, which produced 204.7 pounds of butter fat. What was her test?

```
Process:      6003)204.7000(.0341, or 3.41%
                   180 09
                   ------
                    24 610
                    24 012
                    ------
                      5980
```

Direction to Teacher. — Give much practice in problems of this nature.

4. The fodder of one acre of corn weighed 40,000 pounds. What is the weight of this fodder, when dry, if it loses $62\frac{1}{2}$% in drying?

5. If eggs now sell at 50% more than their selling price ten years ago, what was the selling price ten years ago for eggs that now sell for 36 cents per dozen?

6. 80 chicks from 100 eggs, of which 90% are fertile, is regarded as an extra good hatch. What per cent of fertile eggs hatch?

7. When a dealer buys 30 barrels of flour at $5 per barrel and sells it at $6 per barrel, what is his rate per cent of profit?

QUESTIONS.—Will the rate of profit be any greater on 40 barrels? Suppose the number of barrels is 15?

8. Find the difference between 25 % of 400 and 2.5 % of 400. Of 1.7 % of 56 and 17 % of 56.

9. The milk of a dairy tested 5 % in May, 4.8 % in June, and 4.5 % in July. What was the average test for the three months?

FARM AND MARKET VALUES

The *production value* of a farm product is what it actually cost to produce it.

The *farm value* of a farm product is its market value less the cost of marketing.

The *market value* of a farm product is what it is worth in market.

Problems

1. When $15 is the market value of a ton of hay which it cost a farmer $6 to raise, or produce, what is the farm value of this ton of hay if the cost of marketing it is $3.00?

2. If the production price of a bushel of potatoes is 45 cents, the farm price is 60 cents, and the market price is 70 cents, what is the farmer's profit?[1]

3. If it cost 45 cents to raise a bushel of potatoes and the yield is so large that they sell for 40 cents per bushel in market, what is the farm price and farmer's loss per bushel, if it costs 10 cents per bushel to market these potatoes?

4. The production value of Mr. Brown's hay is $7 per ton, and the farm price is $12 per ton. He has 10 cows, which on the average consume about a ton of hay each during the winter season. What is the value of the hay consumed by these 10 cows during the winter?

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[1] NOTE TO TEACHER.—Let variety of synonymous wording be employed in all problems. Pupils often fail from lack of this, in examinations given by others than their regular teacher.

NOTE. — It is a common error to charge the feed to animals at the cost of production rather than at the farm value.

5. If a farmer raises a ton of hay for $5 and feeds it to steers and gets $8 by so doing,[1] how much does he gain or lose if the market value of this ton of hay is $15, and the cost of marketing is $3?

6. If the farm value of a basket of Kieffer pears is 35 cents and the cost of marketing the pears is 5 cents, what is their market value?

7. When the cost of producing a dozen eggs is 18 cents, and the market value is 25 cents, what is the farm price and the profit on this dozen eggs if the commission man charges 5 per cent for selling them?

THINKING QUESTIONS. — Why is the farm value of products sold always less than the market value? How does the farm value compare with the production value?

8. A farmer grinds his corn into meal which is worth $30 per ton, market value, and buys bran at $24 per ton, market value. If he mixes these feeds in equal parts, by weight, what is the value of the mixture, per ton, if the cost to the farmer of hauling the bran is $2 per ton, and the cost of marketing the corn meal is rated at $2 per ton?

NOTE. — It will be noticed that the farm value of any commodity purchased by the farmer in the market is the market value *plus* the cost of hauling.

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[1] This means that a ton of hay worth $5, when converted into steer, is worth $8.

Market Prices

The following market prices were taken from quotations on July 25, 1914; the class may learn the present market prices for use in their work.

Timothy hay	$21.00	per ton
Clover hay	15.00	per ton
Alfalfa hay	15.00	per ton
Cowpea hay	15.00	per ton
Silage (corn)	3.00	per ton
Oats	24.00	per ton
Shelled corn	28.00	per ton
Ground corn	30.00	per ton
Cottonseed meal	31.00	per ton
Linseed meal	33.00	per ton
Wheat bran	24.00	per ton
Corn fodder	10.00	per ton
Potatoes (white)	0.70	per bushel
Wheat	0.85	per bushel
Cloverseed	10.00	per bushel
Whole milk	1.60	per hundred
Skim milk	0.20	per hundred
Butter	0.29	per pound
Butter fat	0.31	per pound
Eggs	0.25	per dozen

THE COST OF FARM CROPS

Reckon the time of a man and team at $3.50 per day, the man alone at $1.50 per day, in figuring the cost of these growing crops.

1. Find the time and cost of plowing a field that is 48 rods by 40 rods, at the rate of 2 acres per day for man and team.

2. Find the time and cost of harrowing this field twice, at the rate of 12 acres per day for man and team.

3. Find the time and cost of rolling at the rate of 20 acres per day.

4. Find the time and cost of drilling this field with corn, at the rate of 12 acres per day for man and team.

5. Find the time and cost of cultivating the field 4 times, at the rate of 6 acres per day for man and team.

6. Find the time and cost of thinning this corn, at 3 acres per day for 1 man.

7. At a yield of 60 bushels to the acre, what is the cost of harvesting this corn, at 4 cents per bushel?

8. Find the total labor cost of this field of corn.

9. Find the cost of fertilizer, at the rate of 400 lb. per acre, at $25 per ton.

10. Reckoning 8 quarts of seed to the acre, at a cost of $1.00 per bushel, and a rental of $4.00 to the acre, find the total cost of growing this field of corn. How much per acre?

11. What is the value of this crop of corn at a yield of 60 bushels to the acre, at 60 cents per bushel?

12. What is the value of the fodder at 3 cents per bundle, if the yield is 70 shocks to the acre and each shock makes three bundles?

13. What is the net profit on this field of corn?

CORN CROP ACCOUNT

	Dr.		*Cr.*	
Plowing 12 acres	*$ 21*			
Harrowing twice	*7*			
Rolling	*2*	*10*		
Drilling	*3*	*50*		
Cultivating, 3 times	*28*	*00*		
Thinning	*6*	*00*		
Cutting and husking	*28*	*80*		
Rental	*48*	*00*		
Seed	*3*	*00*		
Fertilizer	*60*	*00*		
Value of corn, 720 bu. @ .60			*432*	*00*
Value of fodder, 2520 bdls. @ .03			*75*	*60*
Balance	*300*	*20*		
	507	*60*	*507*	*60*

See *Bulletin of the U. S. Dept. of Agr.:* 414, Corn Cultivation.

HARVESTING PROBLEMS

1. At one dollar per acre, what will be the cost of cutting a field of wheat that is half a mile long and 30 rods wide?

2. Find the amount of this threshing bill:

560 bu. wheat at 4 cents per bushel
800 bu. oats at 2 cents per bushel
1800 lb. coal at $4.50 per ton
4 men and teams at $ 3.00 per day for one day
6 men at $1.50 per day, for one day

3. What was the yield of this wheat per acre, grown in a field 80 rods by 40 rods?

4. The oats field was 100 rods by 40 rods. What was the yield per acre?

5. At one dollar per acre for cutting, and 25 cents per acre for shocking, what was the total cost of harvesting and threshing? What is the expense per bushel?

6. A crib of corn weighs in November, 89,600 lb. How many bushels does the crib contain?

7. Allowing 12.8 per cent for shrinkage, what will be the weight of this corn in the following April?

8. How deep is this crib of corn if it is 30 feet long and 6 feet wide?

Heaped Bushels to Cubic Feet. — To reduce heaped bushels to cubic feet, multiply the number of bushels by 10 and divide the product by $7\frac{1}{2}$. (See rule for reducing cubic feet to bushels, page 25.)

9. When corn is checked 3 feet 6 inches each way, how many hills to the acre?

10. How many stalks to the acre at 3 stalks to the hill?

11. With one good ear from each stalk, how many bushels will you have from an acre, with an average of 100 ears to a bushel?

12. Which will produce the greater yield, a field planted 3 stalks to the hill, bearing ears requiring 120 to make a bushel, or 2 stalks to the hill, requiring 100 ears to make a bushel?

13. Find the cost of harvesting and threshing your father's field of wheat, at local prices.

NOTE TO TEACHER. — Many problems such as No. 13 are given in order to connect school study with home experience. This is a very vital part of the subject.

FARM ESTIMATES

"Conduct your business as though you were living in a glass house."

Bushels in Bin. — To find the number of bushels of grain in a bin, multiply together the length, width, and height in feet, and this product by 8, and cut off the right-hand figure. What does cutting off the right-hand figure do?

1. How many bushels of grain will a bin hold that is 10 ft. long, 6 ft. wide, and $5\frac{1}{2}$ ft. deep?

2. How many bushels of wheat in a bin 10 ft. long, 8 ft. wide, 7 ft. deep, if filled within 1 foot of the top? $\frac{1}{2}$ full? $\frac{3}{4}$ full?

Bushels in Crib. — To find the number of bushels of shelled corn in a crib of ear corn, multiply together the length, width, and height of the crib in feet, and this product by 4, and cut off the right-hand figure.

3. A crib that is 30 ft. long, 4 ft. wide, and 10 ft. high, filled with ear corn, contains how many bushels of shelled corn?

4. Measure your corn crib at home and estimate its capacity in shelled corn.

Heaped Bushels in Bin. — To find the number of heaped bushels in a bin, multiply together the length, width, and height in feet, and this product by $7\frac{1}{2}$, and cut off the right-hand figure.

NOTE. — The preceding rules are based on the fact that a cubic foot (1728 cu. in.) is to a standard bushel (2150.42 cu. in.) approximately as 8 is to 10. While these rules and the following ones are only approximate, they are sufficiently accurate for general estimates.

5. How many bushels of apples in a bin 30 ft. long, 3 ft. wide, and 2 ft. deep?

6. How many potatoes can be shipped in a car that is 36 ft. long, 8 ft. 6 in. wide, and filled to a depth of 4 feet?

Tons in Mow. — To find the number of tons of new hay in a mow, multiply together the length, width, and depth in feet, and divide the product by 500. If hay is well settled, divide by 350.

7. How many tons of hay in a mow 50 ft. long, 20 ft. wide, and 16 ft. deep?

8. Measure the mow of hay at home and tell your father how many tons it contains.

Gallons in Rectangular Tank. — To find the number of gallons in a rectangular tank or cistern, multiply together the length, width, and depth in feet, and that product by $7\frac{1}{2}$, the approximate number of gallons in a cubic foot.

9. How many gallons of water will a cistern hold that is 6 ft. long, 4 ft. wide, and 5 ft. deep?

10. How much water in a cubical tank that is 6 feet on a side, if it is $\frac{2}{3}$ full?

Circumference of Circle. — The circumference (or distance around) a circle is about 3 times the diameter (exactly 3.1416 times).

11. If the diameter of a round stack of hay is 12 feet, what is its approximate circumference?

THINKING QUESTION. — If you know the circumference of a circle, how will you find the approximate diameter?

12. If the diameter of a wheel is 5 feet, what is the exact circumference?

Weight of Cubic Foot of Water. — A cubic foot of water weighs $62\frac{1}{2}$ pounds.

13. A cubical tank of water, 5 feet on a side, is $\frac{1}{2}$ full of water. Find the weight of this water.

Volume of Barrel. — A barrel of water is about 4 cubic feet.

14. How many barrels of water in the tank in problem 13?

Average Yield

Average yield of some of the principal farm crops of the United States as reported for the *Cyclopædia of American Agriculture* (L. H. Bailey) by observers in several parts of the country.

CROP	AVERAGE YIELD PER ACRE	HIGHEST YIELD PER ACRE AND STATE PRODUCING IT
Alfalfa	3.2 tons	10 tons, Washington
Clover	1.6 tons	5 tons, Washington
Maize	26.6 bushels	100 bushels, New York 100 bushels, North Carolina 100 bushels, Indiana 100 bushels, Wisconsin
Oats	30 bushels	150 bushels, Washington
Potatoes	85 bushels	972 bushels, Wyoming
Timothy	1.6 tons	4 tons, New York 4 tons, North Carolina
Wheat	17 bushels	100 bushels, Washington

1. The highest yield of alfalfa per acre is about how many times the average yield? How many even hundred per cent?

See the Table on page 27.

2. The average yield of alfalfa is about what part, or what per cent, of the highest yield?

Direction to Teacher. — Lead pupils to find similar relations in the other crops, also to get the habit of seeing approximate results.

3. Ask your father how the average yield of his different crops compares with the average yields given in the table. How does the yield on your club acre compare with the highest yield of the same crop in the table? Remember what has been done can be done again.

SHIPPING PROBLEMS

"The waste and spoilage of foods between the producer and the consumer is very great."

1. If 10 bushels of fancy apples are put in sample boxes of 5 apples each, how many boxes will these make if a half bushel contains 36 apples?

2. How many bags will it take to hold the sweet-corn produced on 2 acres, if a bag contains 75 ears, and the land averages 2 ears to every 9 sq. ft.?

3. When cherries are picked by the pound and sold by the quart, how much will 1000 pounds sell for at 10 cents per quart, if $1\frac{1}{4}$ pounds equal 1 quart?

4. $1\frac{1}{2}$ tons of grapes are divided into 3 equal lots, and are put into 5-, 8-, and 10-pound baskets. How many baskets in each lot?

5. The cost of raising and marketing a basket of Kieffer pears is about as follows: Cost on tree, 10 cents; picking, 2 cents; hauling, 2 cents; basket and packing paper, 6 cents; shrinkage, 2 cents; freight, 2 cents; drayage, 2 cents; commission, 4 cents. How much is netted on 200 baskets, wholesale price 50 cents per basket?

6. When the cost of raising and marketing early beans is 50 cents per basket, and they sell at $1.50 per basket, the profit is how many times the cost? What per cent is gained?

7. What is the freight on 500 hampers of pears, weighing 50 pounds each, at 15 cents per cwt.?

8. If a fruit-grower has 1000 baskets of Kieffer pears worth 50 cents per basket at picking time, how much will he gain by putting them in cold storage for 3 months, and then selling them at 80 cents per basket, if storage charges are 10 cents per basket, and the loss from shrinkage is 10 %?

Cold Storage. — "The purpose of cold storage is to preserve the excess production of the season of plenty for use in a period of scarcity — to save waste and equalize prices. The reports of the United States Department of Agriculture have shown that many articles of food, such as meat, poultry, fish and apples may be kept in good order for a period of 12 months, if properly prepared for storing and in prime condition when entering the warehouse."

— DR. MARY E. PENNINGTON.

9. A famous fruit-grower, when his peaches are about the size of hickory nuts, picks off about half his fruit so that the remaining fruit grows to about twice the size. If this large variety sells at $1.50 per basket, and the market value of the smaller variety is 75 cents per basket, how much does the fruit-grower gain per basket by thinning his peaches? What per cent does he gain on his crop?

10. A farmer had 500 bushels of corn worth 52 cents per bushel on December 1. He held this corn until July 1, and then received 62½ cents per bushel for it. Did he gain or lose by holding his crop, shrinkage 9 %, and greater cost of hauling, interest, etc., $25?

Corn Shrinkage. — Better prices from holding are generally offset by shrinkage, insurance, interest, storage, greater cost of handling, and so on.

Shrinkage in November	5.2 %
Shrinkage from November to May	14.7 %
Shrinkage in one year	20.0 %

— Warren's *Farm Management.*

11. A market gardener sent his man to the city (12 miles) with a load of 300 cabbages. It took this man $\frac{3}{4}$ of a day to make the trip and sell his load direct to the consumers, for which he received an average of 5 cents per head. At $3 per day for man and team, and 75 cents for lunch, feed, and toll, figure out the profit on this cabbage per 20 heads (1 bbl.), excluding the cost of raising and cutting.

12. For experiment, this same market gardener shipped 5 barrels of cabbage (20 heads each) to the same city via a suburban electric railway to a wholesaler, who sold this cabbage at 75 cents per barrel. The following items show the cost of marketing this cabbage per barrel from the time of leaving the field. Use of barrel, 5 ¢; drayage to shipping point, 8 ¢; freight, 10 ¢; drayage in city, 15 ¢; commission merchant's charges, 7.5 ¢. Figure out the profit per barrel, excluding the cost of raising and cutting.

Note. — The above figures seem to favor retailing, yet general experience shows that the objection to retailing is that the man and horse time are often worth more than the increased prices received.

13. A farmer living fifteen miles from market makes a trip costing $2.50 to deliver 40 pounds of butter at

25 cents a pound. What per cent of what he receives for the butter is consumed in the marketing?

THINKING QUESTION. — How much does he reduce the cost of marketing when he delivers 200 pounds instead of 40 pounds?

14. When a team of horses can haul 3000 pounds, and it takes a whole day to market a load of potatoes, what is the cost of marketing per ton, allowing $1.50 for the man, $1.50 for the team, and $1.00 for other expenses?

15. If these potatoes sell for 90 cents per bushel, how much is that per ton? The expense of marketing these potatoes per ton is what per cent of their selling price per ton?

NOTE. — 5% of the value of a product is regarded as a reasonable cost of hauling.

Fruits and Berries

NORMAL YIELD PER ACRE

Apples	200 bushels	Pears	200 bushels
Blackberries	3000 quarts	Peaches	200 bushels
Cherries	½ bushel per tree	Plums	100 bushels
Currants	3000 quarts	Quinces	50 to 100 bushels
Dewberries	3000 quarts	Raspberries	5000 pints
Gooseberries	3000 quarts	Strawberries	5000 quarts
Grapes	2 tons		

SCALE TICKETS

1. Fill out the scale ticket for 5 loads of wheat, sold at 85 cents per bushel, finding the value of each load and the sum total.

Gross Weight in Pounds	Wagon Weight in Pounds	Net Weight in Pounds	Number of Bushels	Value at 85¢
3465	1175			
3714	1090			
3631	1204			
3655	1146			
3587	1172			
Totals				

> *Test of Scale Ticket.* — The total gross weight minus the total wagon weight should equal the total net weight in pounds. The total number of bushels multiplied by the given value per bushel will give the grand total of the values.

2. Make out and test your scale ticket for 4 loads of corn at 80¢ per bushel. Gross weights: 3346, 3219, 3224, 3305. Wagon weights: 1125, 1142, 1094, 1214.

3. The gross weights of 6 loads of hay are 3416, 3349, 3350, 3407, 3419, 3375. Wagon weights: 1175, 1160, 1204, 1197, 1189, 1191. Make out the scale ticket at $15 per ton.

4. A farmer's gross milk weights for a week ran as follows: 498, 501, 500, 507, 495, 497, 514. Each day 5 cans weighing 17 pounds each were used. This milk averages 3.81 per cent butter fat, and the price of butter fat is 30 cents a pound. Make out a scale ticket and write out a check for the value of this milk, supposing your father to be the shipper, and yourself the dealer.

5. Make out a scale ticket for 8 loads of potatoes, and find the amount received at 70 cents per bushel. Gross weights: 3056, 3020, 3110, 3154, 2916, 3007, 2890, 2940. Wagon weights: 1216, 1224, 1218, 1215, 1234, 1225, 1201, 1207.

6. Six bags of clover seed weigh as follows: 156, 161, 160, 154, 158, 156. Allowing one pound each for the weight of the bag, find the amount of the clover seed, and its value at $10 per bushel.

SOME MARKET CONDITIONS

"A good seller is usually a successful farmer."

1. "A careful analysis of trade conditions indicates that from 33 to 36 per cent of the price which the consumer pays for a perishable article reaches the producer." (Year Book of U. S. Dept. of Agr., 1912.) At the rate of $33\frac{1}{3}$ per cent what does the producer get for a basket of peaches for which the consumer pays $1.50?

2. "About 26% of the cost to the consumer is required for transportation." (Year Book, 1912.) At this rate what is the transportation on a barrel of apples for which the consumer pays $2.50?

3. When the producer sells celery plants at 10 cents per dozen, and the consumer pays 7 cents per plant, what per cent of the price paid by the consumer reaches the producer?

4. A producer painted the hoops of his potato barrels red, and he was soon receiving 10% more for his "red brand" potatoes than other producers received for the same quality. What did he receive per barrel for potatoes selling regularly at $2.00?

5. A quart of tomatoes, bought in Denver for 15 cents, was traced through nine middlemen to Maryland, where it was produced for 4 cents. What per cent of the consumer's price reached the producer?

Middleman. — A middleman is any one who acts as a buyer and seller for profit; he is midway between producer and consumer.

6. A New Jersey farmer sold his celery at 9 cents a bunch. He followed this celery to New York and there saw it sold at 45 cents a bunch. What per cent of the the consumer's price did the farmer get?

Thinking Questions. — What plan is coming into use that will make the delivery from producer to consumer more direct?

How will this affect the middlemen?

Who is the consumer when you sell to a neighbor a bushel of corn raised on your club acre? Who is the producer? Is there any middleman?

7. A New York state apple-grower received $2.50 for a barrel of apples. The profit to the local dealer on this barrel of apples was 25 cents; transportation and refrigeration, 35 cents; commission to wholesaler, 15 cents; cartage, 5 cents; profit to jobber, 20 cents. If the retailer gets $5.00 for this barrel of apples, how much is his profit, including drayage and delivery?

How many middlemen have handled this barrel of apples?

8. If at least $1 could be saved in the handling of this barrel of apples, in going from the producer to the consumer, and that $1 should be divided equally between the producer and consumer, how much would the producer then get for his apples? How much would the consumer pay?

Does your father sell his apples and other produce to a local dealer, a wholesaler (or "commission man"), a jobber, or directly to the consumer?

9. The Eastern Shore Potato Farmers' Exchange (Virginia) sell their produce through selected receivers in New York, Philadelphia, and Boston, who charge 8 per cent commission, of which 3 per cent goes to the agent who solicits the business. What is the receiver's commission, the agent's commission, and what are the net proceeds on a consignment of 1000 barrels of potatoes selling at $2.00 per barrel?

10. A farmer finding it difficult to get 30 cents for tomatoes per $\frac{1}{2}$ bushel basket, conceived the idea of packing and offering them in 4-quart baskets, for which he readily got 12 cents per basket. (*a*) What per cent did he gain by his second plan of selling? (*b*) Why did these tomatoes sell better by the second plan?

11. When the best price that could be gotten for wax beans per bushel was $1.20, they sold readily at 80 cents per peck. What was the retail gain per cent?

12. Apples that would bring only 50 cents per bushel were assorted into two equal lots. The "firsts" sold for 75 cents per bushel and the "seconds" for 35 cents per bushel. (*a*) What per cent was gained by assorting them? (*b*) Is the rate of gain affected by the number of bushels assorted?

13. 10 barrels of apples unsorted are worth $15, but when the culls are taken out, the remaining 8 barrels are worth $2 per barrel, and the culls are worth $1 per barrel. How much is gained on the 10 barrels by culling them?

Value of Middleman. — The farmer is a producer, but of necessity he is not a business man. He cannot, at all times, have that necessary knowledge of trade conditions concerning his products from the time they leave his door until they reach the consumer, which will enable him to make that disposition of them which is most advantageous to himself. There is a place here for the honest middleman.

14. Suppose a farmer, by "facing"[1] his barrels of potatoes, and "piping" his baskets of peaches, sells each at 20% above the regular market price. What does he get for his potatoes selling regularly at $2.00 per barrel, and for peaches selling regularly at 75¢ per basket?

THINKING QUESTION. — Do you think it will really pay the farmer to "face" his potatoes and "pipe" his peaches?

15. When apples are sold for 45 cents per bushel by the producer, for which the consumer pays 30 cents per peck, what is the cost to the consumer per bushel? What per cent represents the producer's price? The consumer's price? The difference between these prices?

PROCESS: 1 pk. sells for 30¢.

1 bu. (4 pk.) sells for $1.20.

100% represents producer's price, or 45¢.

$\frac{120}{45}$ or $\frac{8}{3}$ of 100% or $266\frac{2}{3}\%$ represents consumer's price, or $1.20.

$266\frac{2}{3}\% - 100\% = 166\frac{2}{3}\%$ difference.

In the following problems find similar answers to those found in problem 15 when:

16. The gardener sells beets at the rate of 12 bunches for 20 cents, for which the consumer pays 5 cents a bunch.

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[1] "Facing" potatoes, apples, and similar products for selling purposes means putting the best on the surface, or outside. "Piping" peaches is simply a method of "facing." A pipe is stood in the center of the basket and the small peaches are put into it and the large ones around it on the outside. Then the pipe is removed and more large peaches are put on top, and the basket is "piped," or "faced."

17. The gardener sells cabbage for 75 cents a barrel (20 heads), for which the consumer pays 8 cents a head.

18. The gardener sells tomatoes for 35 cents a bushel, for which the consumer pays 5 cents a quart.

19. Corn, producer's price, 12½ cents per dozen; consumer's price, 30 cents per dozen.

20. Lima beans, producer's price, 80 cents per bushel; consumer's price, $3.20 per bushel.

21. Squashes, producer's price, 10 cents per dozen; consumer's price, 60 cents per dozen.

If the consumer's price of the squashes is 600 per cent of the producer's price, the producer's price is 16⅔ per cent of the consumer's price.

22. The producer's price of the beets is what per cent of the consumer's price? Of the corn? Of the beans?

NOTE. — The prices in problems 15 to 21 are taken from *Market Grower's Journal*, Oct. 1, 1914.

Bulletin 62. — Marketing Farm Produce.

POULTRY PROBLEMS

"A good, well-fed hen should lay 156 eggs a year."

Egg Records. — 500 hens averaged 156 eggs per hen in the second Philadelphia international egg-laying competition in 1913. During the same year, in the Washington contest, 303 eggs were laid by one hen, the highest egg record in the world.

1. The general average price for eggs the year round in this country is about 25 cents per dozen. What is the average income from 5 hens which produce 1000 eggs during the year?

In the year 1913 of the Philadelphia contest, 50 hens out of 500 laid over 200 eggs each, during the year.

2. The yearly average egg yield in United States is estimated at 70 eggs per hen. Find out how well your hens at home are doing by the week at present local prices per dozen, as compared with an equal number of "average" hens at the average price per dozen.

3. What per cent better did the average hen in the Philadelphia international egg-laying competition for 1913 do than an average hen in United States?

4. The average feed cost per hen, the country over, is about $1.25 a year. From problem 1, what is the yearly average income per hen over the feed cost?

5. From the average annual egg yield in United States per hen (70) at an average price per dozen (25 ¢), find the average net profit per hen over the average cost of feed per hen ($1.25).

6. It costs about $1 to feed a hen a year in the Mid-west, and $1.50 in the Eastern States. If eggs sell at 2.5 cents apiece in the Mid-west and 3 cents apiece in the East, in which part of the country is it more profitable to keep hens?

7. If 50 heavy breed birds equal the same number of light breeds as layers, how much better investment are they than the light breeds, if they average 15 pounds per pair at 22 cents per pound, while the light breeds weigh 12 pounds per pair at the same price per pound?

8. It costs about 15 cents to produce a dozen eggs. What is the net income per dozen on these eggs if they are sold at the door for 23½ cents?

9. A housekeeper put 40 dozen eggs down in water glass in April, when the market price of eggs was 20 cents per dozen, and used them the next winter when eggs were 50 cents per dozen. How much did she gain, if the cost of preserving these eggs was 2 cents per dozen?

Water Glass Solution. — The solution of water glass for preserving eggs is 10% water glass to 90% water by measure. Water glass may be bought at any drug or poultry store at about $1.25 per gallon.

10. A poultry woman, by not marketing her eggs for two weeks, had 21 eggs returned as bad. What was her per cent of loss out of 35 dozen?

Eggs should be marketed at least twice a week.

The Egg Type of Fowls

The name, native home, number of varieties and weights of both male and female for each of the breeds of fowls belonging to the egg type:

NAME OF BREED	NATIVE HOME	NUMBER OF VARIETIES	WEIGHT IN POUNDS	
			Male	Female
Leghorn	Italy	8		
Minorcas	Minorca Islands	3	8–9	6½–7½
Andulusians	Andulusia (Spain)	1	6	5
Spanish	Spain	1	8	6½
Red Cap	England	1	7½	6
Hamburg	Holland	6		

General Purpose Breeds

(Both eggs and meat)

NAME OF BREED	NATIVE HOME	NUMBER OF VARIETIES	WEIGHT IN POUNDS	
			Male	Female
Plymouth Rock	United States	6	9½	7½
Wyandotte	United States	8	8½	6½
Java	United States	2	9½	7½
Dominique	United States	1	8	6
Rhode Is. Red	United States	2	8½	6½
Orpington	England	3	10	8
Dorking	England	3	7½–9	6–7
Hoodan	France	1	7	6

The Meat Type of Fowls

NAME OF BREED	NATIVE HOME	NUMBER OF VARIETIES	WEIGHT IN POUNDS	
			Male	Female
Brahma	Asia	2	11–12	8½–9½
Cochin	China	4	11	9½
Langshan	China	2	9½	7½

The general purpose breeds in America have been brought up to such a state of egg production that they now equal the lighter breeds in this respect.

11. When but 11 nests were provided for 60 hens, 7 eggs were broken during the week out of 210 eggs laid. What per cent of the eggs laid were broken?

Half as many nests as birds is a good average.

12. During July, 50 Leghorn hens averaged 19 eggs each, at a cost of 14 cents per hen for feed. What was the net income of these hens for the month, if the eggs sold at 26 cents per dozen?

13. A farmer made a test of the comparative profits of 50 chickens and one cow for a year, with the following results: cost of cow's keep for the year, $ 52; value of milk sold, $ 144.10; cost of hens' keep, $ 50; value of eggs, $ 150.80.

Which was the better investment, regarding the labor cost and manure value of the cow equal to that of the hens?

14. White eggs and brown eggs, equally mixed, sold in New York City at 25 cents per dozen. When assorted, the white eggs brought 27 cents per dozen, and the brown eggs still brought 25 cents per dozen. (*a*) What per cent was gained by assorting them? (*b*) Is the rate of gain affected by the number of eggs assorted?

White and Brown Eggs. — "This is a good illustration of market fashions, since the most careful chemical analyses have so far failed to show any difference in the composition of the eggs themselves." — *Year Book*, Dept. of Agr., 1910.

How eggs are generally marketed:

1. Gathered by farmer.
2. Traded with the village merchant, or
3. Bought by local dealer.
4. Bought by city receiver, by wire.
5. Grocer.
6. Consumer.

NOTE. — Very often the eggs go from the city receiver to the jobbing house, thence to the grocer.

15. Elements of cost of a dozen eggs purchased by a New York consumer:

Paid to farmers in Iowa	.15
Profit of country store	.00
Gross profit of shipper	.00¾
Freight to New York	.01½
Gross profit of receiver	.00½
Gross profit of jobber	.01¼
Loss from handling	.02
Gross profit of retailer	.04

(*a*) What is the cost to the consumer?

(*b*) The producer's price is what per cent of the consumer's?

(*c*) Whose profit is the largest in marketing the above dozen eggs? Why is this?

(*d*) See how far you can trace the course of a dozen eggs sold at your home.

"*Candling*" *Eggs.* — Eggs are "candled" to show the difference between fresh eggs, stale eggs, heated eggs, blood rings, mixed rots, etc. A "candle" may be made from a pasteboard egg case flat rolled into a tube through which you look at the egg by the sunlight or other transmitted light.

"*Firsts*" are fresh, large, clean eggs, with sound shells, weighing at least 45 pounds to the case of 30 dozen.

"*Seconds*" are clear, sound-shelled, undersized eggs, and may be fresh, or shrunken and stale from long holding.

16. "Out of 4 cases (30 dozen each) of eggs, 25 % graded as 'firsts,' 60 % as 'seconds,' 5 % were cracked, and 4 % were rotten. How many dozen eggs were there of each kind?" — *Year Book*, Separate 552, 1910.

"*Case Count*" *and* "*Loss Off.*" — Buying eggs by "case count" means that they are bought as counted from the farmer's case, regardless of condition or quality. Buying eggs "loss off" means that the eggs are candled and the farmer sustains the loss of the rotten and broken ones. Which is more fair? Which is better for the egg market?

17. The country egg dealer bought 40 dozen eggs from a farmer at 20 cents per dozen, "case count." How much would the farmer have lost if these eggs had been bought "loss off," if 4 % were rotten and cracked?

18. When a dealer paid 35 cents for "firsts" he paid 28 cents for "seconds" and 21 cents for "thirds" or "dirties." The average market price for eggs in his vicinity at the time was 27 cents. What per cent above market price did the producer of the "firsts" receive? What per cent did he receive over the price paid for the "thirds"?

QUESTION. — Does it pay to produce good eggs?

Rules for Handling Poultry and Eggs

It is urged that all farmers and poultrymen adhere strictly to the following rules in handling their poultry and eggs:

1. Keep the nests clean.
2. Gather the eggs twice daily.
3. Keep the eggs in a cool dry room or cellar.
4. Market the eggs at least twice a week.
5. Sell, kill, or confine all male birds as soon as the hatching season is over.

Hints concerning Eggs

A splendid mixture for laying hens is made of equal parts of cracked corn, wheat, and oats, which should be scattered in the litter.

Bran or middlings and beef scraps should be kept in receptacles to which fowls have access at all times.

Removing the male bird has no influence on the number of eggs laid by the hens.

Market white-shelled and brown-shelled eggs in separate packages.

When selling eggs to the country merchant or cash buyer, insist that the transaction be on a quality basis.

Infertile eggs will withstand marketing conditions much better than fertile eggs.

Yearly Egg Record

DAY OF MO.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	6											
2	4											
3	5											
4	5											
5	7											
6	6											
7	5											
8	3											
9	6											
10	7											
11	5											
12	6											
13	7											
14	7											
15	6											
16	8											
17	7											
18	9											
19	9											
20	10											
21	9											
22	8											
23	8											
24	9											
25	7											
26	7											
27	9											
28	10											
29	11											
30	9											
31	10											
Total												
Average No. hens												
Average No. eggs												

1. Find the total for January; the average.

2. Find the average number of hens by taking the average between the number of hens at the beginning and the end of the month.

3. Find the average number of eggs by dividing the total number of eggs by the average number of hens.

Bulletins. — Every person interested in the production of poultry and eggs should have the following bulletins in his library, any of which may be had from the United States Department of Agriculture by sending a postal card request.

Farmers' Bulletins:
  528. Hints to Poultry Raisers.
  287. Poultry Management.
  51. Standard Variety of Chickens.
  445. Marketing Eggs through the Creamery.
  355. A Successful Poultry and Dairy Farm.
  530. Important Poultry Diseases.
  Circular No. 64, 1910.
Studies of Poultry from the Farm to Consumer.
Year Book, Separate 596, 1912.
How the Produce Dealer May Improve the Quality of Poultry and Eggs.

POULTRY FEEDING

"There is more in the feed than in the breed."

1. The 500 hens in the Philadelphia international egg-laying competition are all fed alike at a cost of $1.50 per bird a year. The following are the proportions :

Cracked corn	60 lb.	Barley	20 lb.
Wheat	60 lb.	Kaffir corn	10 lb.
White oats	40 lb.	Buckwheat	10 lb.

As a mash the following mixture is kept in pans before the birds all the time :

Coarse bran	200 lb.	Standard middlings	75 lb.
Corn meal	100 lb.	Fish scrap	30 lb.
Gluten feed	100 lb.	Beef scrap	30 lb.
Ground oats	100 lb.	Low grade flour	25 lb.

2. Feed for fattening poultry :

60 lb. corn meal @ $1.50 per cwt.
40 lb. middlings @ $1.40 per cwt.
5½ lb. beef scraps @ $2 50 per cwt.
1½ lb. sour milk to every pound of the above @ $.20 per cwt.

Find the cost of the mixture.

The above feed, which is designed for general farm use, is given by Professor M. C. Kilpatrick, of Pennsylvania State College, as a result of investigational work.

3. When a poultryman was feeding 344 pounds of skim milk to his flock of 1500 hens per day, they averaged 62 dozen eggs per day. But when these hens had no skim milk they averaged 38 dozen eggs per day. If eggs were selling at 31 cents per dozen, what was the value to the poultryman of this skim milk per hundred pounds? Per gallon?

4. Winter mixture for making hens lay (Cornell):

Wheat	100 lb.
Corn, cracked	100 lb.
Oats	50 lb.

Find the cost of this mixture from prices quoted on page 20.

Scatter this mixture in the litter early in the morning and again at about 11.30 A.M. This produces abundant exercise.

Ground feed to be fed as a dry mash:

Corn meal	60 lb.
Wheat middlings	60 lb.
Wheat bran	30 lb.
Alfalfa meal	10 lb.
Oil meal	10 lb.
Beef scrap	50 lb.
Salt	1 lb.

NOTE. — Poultry housing problems will be found on page 199.

SHIPPING EGGS BY PARCEL POST

In marketing eggs, the farmer who does not have good marketing facilities may find the parcel post a satisfactory means of sending this product directly to the consumer. This applies especially to the small producer within a small radius, as the first and second zones.

Average hen eggs weigh about 1½ pounds to the dozen, or 2 ounces apiece. A single dozen eggs in a carton packed for mailing, weighs generally from 2 to 3 pounds.

TABLE OF FIRST AND SECOND ZONE PARCEL POST RATES

Pounds	*Postage, Cents*	*Pounds*	*Postage, Cents*	*Pounds*	*Postage, Cents*
1	5	18	22	35	39
2	6	19	23	36	40
3	7	20	24	37	41
4	8	21	25	38	42
5	9	22	26	39	43
6	10	23	27	40	44
7	11	24	28	41	45
8	12	25	29	42	46
9	13	26	30	43	47
10	14	27	31	44	48
11	15	28	32	45	49
12	16	29	33	46	50
13	17	30	34	47	51
14	18	31	35	48	52
15	19	32	36	49	53
16	20	33	37	50	54
17	21	34	38		

The weight limit within the first and second zones is 50 pounds. These rates apply to all points within the first and second zones, there being no difference in rates between these two zones.

Oral Problems

1. What is the postage on a carton of 2 dozen eggs weighing 5 pounds?

2. What is the postage on a carton weighing $11\frac{1}{2}$ pounds? On one weighing 21 pounds and 5 ounces? What relation do you see between the weight and the postage of any given number of pounds?

The measurement limit, which is the same for all zones, is that the girth, or distance around the parcel, added to the length of the parcel, must not exceed 72 inches.

3. What is the measurement of a parcel 8 inches square and 20 inches long? Of a parcel 10 inches square and 32 inches long?

4. What is the measurement of a cubical parcel 12 inches on a side? Of a parcel 10 inches wide, 4 inches high, and 15 inches long?

5. Would a cubical parcel 15 inches on a side come within the measurement limit?

Observe from the table that the heavier the parcel (within size and weight limits) the cheaper the postage per pound.

6. How much less is the postage on a 2-pound parcel per pound, within the first and second zones, than on a 1-pound parcel? On a 10-pound parcel, per pound, than on a 5-pound parcel?

7. To market a two-dozen sized parcel of eggs would cost about 8 cents for container and wrapper, and 9 cents for postage. What would be the cost of marketing a dozen of these eggs?

8. To market a 10-dozen parcel would cost about 22 cents for container and wrapping, and 25 cents for postage. How much less would the cost be per dozen in 10-dozen lots than in 2-dozen lots?

Club Shipments. — To ship eggs fresh and often, it would be cheaper and more practical for farmers to club together when sending to the same point, as to a hotel, restaurant, or retail-grocer.

Washing Eggs. — Eggs intended for high-class trade should never be washed.

DAIRY PROBLEMS

Soil efficiency + cow efficiency = farm prosperity.

Weight of Milk. — A quart of milk weighs about 2⅛ pounds.

1. When a cow gives 12 quarts of milk a day, how many pounds is she giving?

Average Production in Time. — On an average, cows produce milk during ten months in the year.

2. A cow producing 5000 pounds of milk a year gives an average of how many quarts per day?

3. Find the average annual production of the milk of a dairy of 8 cows making the following returns: 4156 lb.; 3506 lb.; 4217 lb.; 5001 lb.; 3907 lb.; 7263 lb.; 4976 lb.; and 3870 lb.

Average Production in Pounds. — The average annual milk production of the dairies of the United States is about 4000 lb. per cow.

Butter Fat. — Butter fat is the fat of milk from which butter is made. The average per cent of butter fat in the dairies of the United States is about 4 %.

4. The tests in butter fat of the milk in problem 3 are as follows: 4.02 %; 5.6 %; 3.8 %; 4.5 %; 4.9 %; 3.5 %; 5.12%; and 4 %. Find the average test.

5. During one month a dairy of ten cows produced 4850 pounds of milk, which tested 4.31 % butter fat. How many pounds of fat did the milk contain?

4.31 % written decimally is .0431.

6. (*a*) Which cow is more profitable, one producing 5400 lb. of milk a year testing 3.4 %, or one producing 4815 lb. testing 4.5 %? (*b*) Upon what two items does the profit of a cow depend?

7. Which pays better, a cow averaging 3 gallons of milk per day testing 3.4 %, or one averaging $2\frac{1}{2}$ gallons per day testing 4.5 %?

8. A farmer's milk production for a month is 4648 lb. At $ 1.60 per hundred pounds of milk, what would be the amount of his milk check?

Creameries. — Creameries pay the farmer so much per hundredweight for his milk, according to the average test of butter fat it contains for the month.

"*Overrun*" is the difference between the pounds of butter and the original pounds of butter fat, due to the butter containing water, casein, salt, and other substances.

For instance, from 75 pounds of milk that tests 4 %, 3 pounds of butter fat are obtained, and from this about $3\frac{1}{2}$ pounds of butter may be made. The difference, or $\frac{1}{2}$ pound of butter, is the overrun, and this is $\frac{1}{6}$, or $16\frac{2}{3}$ %, of the butter fat.

In creameries, overrun varies from 10 to 20 per cent.

9. A farmer sends to a creamery during one month 8563 pounds of milk, having a test of 4.3 %. How much fat does it contain? How much butter should it make, allowing $\frac{1}{6}$ for overrun?

PROCESS: 8653 lb. × .043 = 372 lb. fat.
372 lb. × $\frac{1}{6}$ = 62 lb. overrun.
372 lb. + 62 lb. = 434 lb. butter.

10. At 29 cents a pound, what is the value of the butter from a cow producing 6000 pounds of milk in a year, testing 4.6 %, overrun $\frac{1}{6}$?

QUESTION FOR INQUIRY. — Who gets the overrun when the farmer is paid on the butter fat basis, the creamery or the farmer?

11. A milk dealer pays the producer $1.60 per hundredweight for milk testing 4 per cent. At this rate what is the value of 265 pounds of milk testing 3.5 per cent?

12. From the average number of pounds of milk produced annually per cow in the United States, and the average test, figure out the average annual butter production per cow.

It is interesting to note that the milk and butter production are on the increase.

AVERAGE PRODUCTION PER COW IN UNITED STATES

YEAR	MILK	BUTTER	YEAR	MILK	BUTTER
	Pounds	*Pounds*		*Pounds*	*Pounds*
1850	1436	61	1890	2709	115
1860	1505	64	1900	3646	155
1870	1772	75	1910	3732	165
1880	2064	85			

13. How many pounds of milk testing 3.8 % will a cow have to give to equal in butter fat the milk of a cow giving 5490 pounds testing 4 %?

Whole Milk. — Whole milk is milk from which no cream has been taken.

14. When skim milk is figured at 85 % of whole milk, and is valued at 20 cents per hundredweight, what is the value of the skim milk from five 40-quart cans of whole milk?

15. From the following general average conditions of a cow producing 4000 lb. of milk a year testing 4 %, find the profit for one year:

Value of fat, 160 lb. at 27¢ per pound	$43.20
Value of skim milk, 3400 lb. at 20¢ per hundredweight	6.80
Value of calf	3.50
Value of manure at $1.50 per ton	14.50
Value of feed	38.00
Value of labor	18.00
Dairy utensils, insurance, buildings, veterinary, depreciation, etc.	11.00

The above figures are taken from Circular 134, Illinois, by F. J. Fraser.

16. What is the profit in the above problem when labor is not considered in expense account?

NOTE. — Many farmers, in estimating the profits of their dairy, fail to consider any items except the food cost on the one hand, and the milk receipts on the other. A little study of problem 15 shows that the consideration of these two items alone will not give a true estimate of what a dairy is paying. However, on the smaller farms, the labor cost may be omitted on the general principle that extra labor is not required for the dairy work, as it is done by the members of the family.

17. Omitting the food cost, and butter fat receipts in the above problem 15, how do the total remaining expenditures compare with the total remaining receipts?

18. From the conditions in problem 15, figure out how much better off Mr. A is at the end of the year by keeping 8 cows averaging 5000 pounds of milk each, testing 4 %, than his neighbor Mr. B is, who keeps 10 cows averaging 4000 pounds, testing 4 %, allowing the total expense of Mr. A's cows' keep per head to be $ 3.00 more than Mr. B's.

REMARK. — "The farmer should not be satisfied to keep any cow on his farm which gives an annual yield of less than 5000 pounds of milk, unless her butter fat runs 5 % or above."

QUESTION FOR THOUGHT. — Why is it better business to keep five 10,000-pound cows than to keep ten 5000-pound cows?

19. It cost a Western farmer $ 52 a head to feed his cows a year. One of these cows produced 4942 lb. of milk testing 3.9 % ; the second, 3361 lb. testing 3.5 % ; the third, 4700 lb. testing 5 % ; the fourth, 4738 lb. testing 5.5 % ; the fifth, 4516 lb. testing 4.2 % ; the sixth, 5000 lb. testing 4.2 %. Find the profit on these cows on a food basis only, allowing the skim milk, manure, etc., to balance labor, etc. Counting butter fat at 31 cents a pound, which cow was the most profitable? Were any kept at a loss?

"*Boarders.*" — What is a "robber" cow, or "boarder"? Find out whether your father keeps any boarders in his dairy.

20. At the average content of butter fat (4 %), how many pounds of milk must a cow give per month to produce sufficient butter fat at 25 cents a pound to balance her food value for the year, at a cost of $ 42 per year?

PROCESS: $ 42.00 ÷ 10 = $ 4.20 cost per month.
4.20 ÷ .25 = 16.8 lb. fat.
16.8 lb. ÷ .04 = 420 lb. milk.

NOTE. — Since the cow pays for her feed for the year in ten months, $4.20 is what she pays in one month for 1⅕ months' feed.

21. Get the test of your father's worst cow and figure out how much milk she will have to produce in 30 days to pay for her feed for that time, butter fat worth 31 cents per pound.

NOTE. — Regarding the much-debated question among farmers as to whether better feeding will increase the per cent of butter fat in milk, a recent communication from the Dairy Division of the Bureau of Animal Industry states that "when the cow is receiving fairly good rations it is not possible to materially and permanently change the per cent of fat in the milk by feeding her a ration richer in fat. However, if the cow is in very poor condition, this may be possible to a very limited extent."

22. From the production and test of your father's best cow, and the present local price of butter fat, figure out how much money she is clearing over her feed.

Babcock's Tester. — Every farmer should have a Babcock's tester (cost $4 to $6) and a pair of scales (cost $3 to $5).

23. Which is better for the dairyman, to sell the annual milk production of a cow giving 5,753.1 pounds at $1.60 per hundred, or to sell it for butter, 4.54% butter fat, at 31 cents a pound, and skim milk at 20¢ per cwt.?

Residual Fat. — Some fat is bound to remain in the skim milk, whatever method is used for taking the cream from it.

By using separator, about .05 per cent remains.
By using deep pans, about .2 per cent remains.
By using shallow pans, about .8 per cent remains.

24. What is the butter fat loss from 1000 pounds of skim milk, when cream is obtained by separator? By deep pans? By shallow pans?

25. When milk is "set" in shallow pans there is $\frac{3}{4}$ of a pound of butter less in every 100 pounds of milk than when the separator is used. In a dairy of ten cows, what would be the loss by the old plan for a year, if they average 4800 lb. of milk each, and the butter sells at 30 cents a pound?

26. In a test for a year, 4 cows that were angular and spare made an average profit of $46.25 each in dairy products over the cost of food, while 4 cows of the beef type gave a corresponding return of only $26.19 per cow. How much more money was made from the dairy type of cows than from the beef type?

Specific Gravity of Milk. — The specific gravity of milk is the weight of a certain volume of milk compared with the weight of an equal volume of water, both at a temperature of 39.2° Fah.

For instance, a can containing 86 pounds of milk will hold $83\frac{1}{3}$ pounds of water. Then the specific gravity of the milk is $86 \div 83\frac{1}{3}$ or 1.032. That is, milk is 1.032 times heavier than an equal bulk of water.

27. How much milk can be put into a tank which will hold 1000 pounds of water?

PROCESS: $1000 \text{ lb.} \times 1.032 = 1032$ pounds.

28. Brindle cow gives 20 lb. of milk per day testing 4.6%; Flotsam 23 lb. testing 3.8%; Spotty 18 lb. testing 5%; and Peaceful 27 lb. testing 4.5%. What is the average test of these four cows?

PROCESS: 20 lb. testing 4.6% equivalent to 92 lb. testing 1%.
23 lb. testing 3.8% equivalent to 87.4 lb. testing 1%.
18 lb. testing 5% equivalent to 90 lb. testing 1%.
27 lb. testing 4.5% equivalent to 121.5 lb. testing 1%.
390.9 lb. test 1%.
88 lb. test 4.44%.

FARMERS' BULLETINS:

413. The care of milk and its use in the home.
106. Breeds of dairy cattle.
55. The dairy herd.
347. The dairy industry in the South.

Bacteria in Milk

Bacteria are the lowest forms of vegetable life, so small that a single drop of milk may contain 40,000,000 of them. Their increase in numbers in milk varies with temperature, being greatest between 80° and 100° Fahrenheit. If milk is cooled to 50°, or, better still, to 40°, their growth is very slow.

1. At a temperature of 50° bacteria increase in numbers 1.5 times in 12 hours, but at 68° they increase 24.2 times in 12 hours. If some milk contained 1000 bacteria when first milked, how many more would the milk cooled to only 68° in 12 hours contain than that cooled to 50°?

2. If milk has 500 bacteria to a cubic centimeter, and these bacteria double every 30 minutes, how many would there be in 6 hours?

Milk is *sterilized* by applying sufficient heat to destroy all bacteria.

Milk is *pasteurized* by applying sufficient heat to destroy part of the bacteria.

The farmer should take precautions to prevent the undue multiplication of bacteria. This can be done by cooling the new or fresh milk at once to a temperature of 50 degrees or less.

Certified milk is milk that is produced by special agreement and regulations which certify to the high quality of the product. It commonly retails for 10 to 18 cents per quart.

Standardized milk is milk that has been changed in its composition so that it contains a required amount of fat, usually by adding cream or skim milk.

THE COST OF RAISING A DAIRY COW

1. There are 21,749,651 dairy cows in United States. How many heifers must be raised annually to maintain this number, if the productive life of a cow is 8 years?

Tables

The following tables are from a bulletin of the U. S. Department of Agriculture issued in 1914, on the "Cost of raising a Dairy Cow," to the age of two years.

TABLE I. — QUANTITY OF FEED PER DAY FED DURING DIFFERENT MONTHS TO A YEARLY AVERAGE OF 20.42 HEAD OF CALVES, FOR FIRST YEAR

YEARS AND MONTHS	AVERAGE NO. FED	WHOLE MILK	SKIM MILK	MIXED HAY	CORN SILAGE	GRAIN MIXTURE	PASTURE
1909		Lb.	Lb.	Lb.	Lb.	Lb.	Days
September . .	6.3	11.6	0.1	—	—	—	—
October . .	18.0	6.2	2.9	0.4	—	3.4	—
November . .	22.0	1.3	9.3	.7	0.3	1.8	—
December . . .	23.0	.5	10.5	1.8	—	2.0	—
1910							
January . . .	23.0	.2	14.5	3.0	1.2	2.4	—
February . . .	23.0	—	11.8	3.1	1.7	2.4	—
March	23.0	—	11.8	4.8	1.2	2.4	—
April	23.0	—	18.8	4.2	2.3	2.1	—
May	23.0	—	12.4	5.5	2.8	2.1	31
June	20.7	—	1.8	2.3	1.1	.7	30
July	20.0	—	—	—	—	—	31
August	20.0	—	—	—	—	—	31
Total per head per year		342	3165	857	353	547	123

TABLE II. — RELATIVE FEED COST PER HEAD OF CALVES DURING THE FIRST YEAR

YEAR AND MONTH	AVERAGE NUMBER FED	WHOLE MILK	SKIM MILK	MIXED HAY	SILAGE	GRAIN MIXTURE	PASTURE	TOTAL
1909								
Sept.	6.3	$5.26	$0.01	$0.01	——	$0.02	——	$5.30
October	18.0	2.86	.18	.05	——	.14	——	3.23
Nov.	22.0	.64	.56	.09	$0.01	.68	——	1.98
Dec.	23.0	.27	.65	.23	——	.77	——	1.92
1910								
Jan.	23.0	.08	.90	.38	.07	.98	——	2.41
Feb.	23.0	——	.66	.34	.10	.85	——	1.95
March	23.0	——	.73	.53	.07	.93	——	2.26
April	23.0	——	1.13	.51	.14	.78	——	2.56
May	23.0	——	.77	.69	.17	.83	$0.30	2.70
June	20.7	——	.11	.40	.07	.28	.50	1.36
July	20.0	——	——	——	——	——	.50	.50
August	20.0	——	——	——	——	——	.50	.50
Yearly cost per head		5.22	6.33	3.56	.70	6.94	1.83	24.5

In working out these problems consult the tables.

2. The total cost of keeping a calf the first month is what per cent of the total cost for the first year?

QUESTION. — Why is the cost the greatest during the first month?

3. What is the total cost of an average calf at the end of eight weeks from birth, estimating the value of the calf at birth, or as a "monkey," at $3.50?

NOTE. — An average calf means one that is not thoroughbred. The initial value, $7, given in Table III is for thoroughbreds.

TABLE III. — TOTAL COST OF A CALF FROM BIRTH UNTIL IT ENTERS THE DAIRY HERD AT THE AGE OF TWO YEARS

ITEM OF COST	FIRST YEAR		SECOND YEAR		TOTAL	
	Actual Cost	Per Cent	Actual Cost	Per Cent	Actual Cost	Per Cent
Feed	$24.58	68.4	$16.11	63.8	$40.69	65.6
Labor	5.14	14.3	2.86	11.0	8.00	12.9
Interest	1.12	3.1	2.53	9.9	3.65	5.9
Buildings	1.57	4.4	.81	3.1	2.38	3.8
Equipment	.55	1.5	——	——	.55	.9
Bedding	1.00	2.8	2.00	7.8	3.00	4.8
Miscellaneous expenses	.28	.8	.16	.6	.44	.7
General expenses	1.71	4.7	1.22	4.8	2.93	4.7
Losses by death and discarding	——	——	——	——	.42	.7
Total	35.95	100.0	25.69	100.0	62.06	100.0
Credit manure	3.00		5.00	——	8.00	
Total cost of raising	32.95		20.69		54.06	
Initial value of calf	7.00				7.00	
Total net cost	39.95		20.69		61.06	

4. What is the profit on this calf at 8 weeks of age, weighing 196 pounds, at 12 cents a pound?

5. The prices of the different feeds for the second year are as follows: Hay, $4.60; silage, $6.50; corn stover, $1.45; and pasture, $3.56. How much less does the feed for the second year cost than for the first year?

6. The cost of labor for the second year is $2.86 per head. How much less is the cost of feed and labor for the second year than for the first year?

QUESTION. — Why is the cost of labor less for the second year than for the first year?

7. What is the total cost of the other items for the two years outside of feed and labor?

8. An increase of 10 per cent in the price of feeds would add how much to the cost of the heifer for the two years?

9. Counting the feeding cost of a heifer at exactly $ 40 for two years, and the net cost at $ 60, how much will the profit be by selling a heifer at $ 56, if raised in a section of country where feeds are 20 % cheaper?

DAIRY FEEDING

"The stingy feeder cheats himself as well as the cow."

Since each cow gives her best results of the year when pasturing on ordinary grasses in the early summer, the great problem in winter feeding is, in general, to imitate these summer conditions. It is entirely possible to have these summer conditions throughout the winter on any farm when the subject is understood and the proper arrangements are made.

The summer conditions which are to be kept up as far as possible throughout the year are:

1. An abundance of palatable food.
2. A balanced ration.
3. Succulent feed.

I. An Abundance of Palatable Food

The first summer condition which may be profitably imitated through the winter months is an abundance of palatable food.

A *ration* is a daily allowance of food.

A *ration for maintenance*, for a cow, is the amount of food required to keep her alive without giving any milk or gain of weight.

A *full ration for maintenance and milk* is the maintenance ration plus the amount of feed the cow eats over and above the maintenance ration, up to the limit of her inherent milk-making ability.

Under ordinary circumstances, the amount of milk which a cow gives is directly in proportion to the amount of feed which she eats in excess of the maintenance ration.

If the cow eats more than the full ration for maintenance and milk, she stores the excess up in her body in the form of fat, to be given off later when her milk-making power calls for more material than her daily ration supplies; if she eats less, she either robs her body, or lessens her milk yield, or both.

The above statements are shown by the following diagrams:

Ration for maintenance only:

Maintenance
1000-lb. cow

When fed not enough:

Ration for maintenance +	milk
Maintenance	milk
1000-lb. cow	10 lb. 4 % milk

When fed just enough:

Ration for maintenance +	milk
Maintenance	milk
1000-lb. cow	20 lb. 4 % milk

When fed too much:

Ration for maintenance +	milk +	fat
Maintenance	milk	fat
1000-lb. cow	20 lb. 4 % milk	Gain in weight

Note. — The market values of feeds, rather than the farm values, have been given in this chapter, since the cost of hauling, in different neighborhoods, would make a lack of uniformity in the farm values. It might be well to let the local farm values be determined and substituted.

In the ordinary-sized cow the ration for maintenance amounts to about 60 % of the total feed of the animal, the other 40 % being used exclusively for milk production. — Per cents from Henry's *Feeds and Feeding.*

1. If a cow is fed only 90 % of her full ration for maintenance and milk, what part of her full milk production will she give?

2. A certain cow produces 16 quarts of milk on a full ration of 45 pounds. How many quarts of milk will she produce if her ration is cut down to 36 pounds?

NOTE. — The cutting down of that part of the ration which goes toward milk production is one of the most common mistakes made on the farm.

3. If it costs 10 cents a day for feed to maintain a cow, and 3 cents a day to make her give 10 pounds of milk, what is the daily profit, if the milk sells at $1\frac{1}{2}$ cents a pound?

4. What would have been the profit if it had cost 10 cents a day to maintain the cow and 7 cents to make her produce 20 pounds of milk, the milk selling at $1\frac{1}{2}$ cents a pound?

5. What would have been the profit if it had cost the same to maintain the cow and 12 cents per day to make her produce 30 pounds of milk, selling at $1\frac{1}{2}$ cents a pound?

A Fixed Feed. — The first requirement of every animal, the ration for maintenance, is a fixed feed. That is, it is practically the same whether the animal is being kept for its greatest production, or if it is merely being kept without producing any milk at all. After the feeder has gone to the expense of the maintenance ration, it is poor economy to refuse to furnish the other 40 per cent of the ration, which the cow would use entirely for milk production.

In practice, however, if the full ration (diagram 3) were reduced one half, while this cutting down would remove all available feed for milk production, the cow would not cease producing milk at once. This is a point of greatest importance in feeding cows, and one which is apt to be overlooked.

Feeding Individually.— In regard to the amount to feed cows, it is only possible to feed a number of cows economically when they are fed individually, not all alike. However, dairymen cannot afford to feed a separate grain mixture to each cow, but from a general mixture for a herd they can vary the *amounts* to the different cows according to the following conditions: (1) the size of the cow; (2) the daily milk yield; (3) the time the cow has been in milk.

Grain Mixture for Herd

200 lb. bran	@ $24 per ton
100 lb. corn meal	@ 30 per ton
125 lb. linseed meal	@ 33 per ton
100 lb. cottonseed meal	@ 31 per ton

6. Find the cost of this grain mixture.

General Rule for a Day's Feeding. — Feed 1 pound of hay and 2½ pounds of silage to every 100 pounds live weight of cow, and 1 pound of grain (about 1 quart) to every 3 or 4 pounds of milk produced.

7. How much hay, silage, and grain will it take to feed a cow weighing 1200 pounds and producing 30 pounds of milk?

8. How much will this ration cost per month at prices already quoted? (The hay may be either clover, alfalfa, or cowpea.)

Classes of Feed

All animal foods are divided into two classes, according to their bulk—namely, roughage and concentrates. Roughage includes all the coarse portions of a ration, as hay, fodder, silage, and roots; the term "concentrates" includes all grains and mill products.

In feeds there are three groups of substances which must be considered in preparing a ration that will secure the best results. These are protein, carbohydrates, and fat.

Protein is a compound containing nitrogen, which is costly in feeds and fertilizers, but no element can take its place. It is found in clover, alfalfa, cowpea hay, cottonseed, linseed, and gluten meal. Protein forms nearly one third of the solid materials found in milk, and since most of our common feeds do not contain a sufficient amount, we purchase such foods as linseed oil, gluten feed, cottonseed meal, bran, and other feeds rich in protein.

The carbohydrates are present in large quantities in nearly all grains, such as corn, wheat, and barley.

The fats are found in varying quantities in all common grains.

As a rule the common feeding stuffs contain relatively small amounts of protein and fat, but are rich in carbohydrates.

II. A Balanced Ration

The balanced ration is the second summer condition which should be kept up the entire year.

A *balanced ration* is one in which these three solids — protein, carbohydrates, and fats — are furnished in the feed in sufficient quantities, and in about the right proportions, so that there will be no loss.

The following is a simple method of balancing rations, planned by H. H. Wing:

Low Protein Group		Medium Protein Group		High Protein Group	
Total Protein 12 % or Less		Total Protein 12 % to 25 %		Total Protein 25 % or More	
Corn	10.3	Wheat bran	15.4	Malt sprouts	26.3
Oats	11.4	Mixed wheat feed	16.3	*Linseed oil meal*	33.9
Wheat	11.9	Standard wheat middlings	16.9	*Cotton meal*	45.3
Rye	11.3	*Flour wheat midds.*	19.2	*Gluten feed*	25.0
Barley	12.0	*Cottonseed feed*	20.0	Brewers' dried grains	25.0
Buckwheat	10.8	Buckwheat feed	18.3	Distillers' dried grains	31.2
Hominy chop	10.5	*Pea meal*	20.2	*Buckwheat midds.*	26.7
Dried beet pulp	8.1	*Cull beans*	21.6		
Corn & cob meal	8.5				

"Heavy" foods are in italic, "light" foods in common type.

Mixed hay, corn, silage, cornstalks, or fodder are very similar in composition so far as balance between protein and carbohydrates is concerned.

A well-balanced ration can be made if one low protein, one medium protein, and one high protein food be mixed in equal parts by weight, to be used with the above kinds of roughage.

Make a balanced ration for a 1000-pound cow, producing 24 pounds of milk. (See rule, page 70.)

1.

10 pounds mixed hay	@	$16.00 per ton
25 pounds corn silage	@	3.00 per ton
3 pounds corn meal	@	30.00 per ton
3 pounds bran	@	24.00 per ton
3 pounds gluten meal	@	27.00 per ton

Find the cost of this ration for 7 months.

Note. — An ideal grain ration should contain at least one "light" food, thus making it weigh about one pound to the quart.

2. Make a balanced ration for a 1400-pound cow yielding 40 pounds of milk.

As an aid in properly balancing the rations, it is helpful to divide our common feeds into two classes:

Class 1. — Feeds containing a large amount of fat-producing materials (carbohydrates and fat) but little protein.

Corn
Corn fodder
Corn silage
Timothy hay
Oat straw
Wheat straw
Millet hay
Sorghum hay

Class 2. — Feeds containing a larger proportion of protein, but little of the fat-producing materials.

Clover hay
Alfalfa hay
Cowpea hay
Bran
Oats
Cottonseed meal
Linseed meal
Gluten meal

Question. — Could a properly balanced ration be made by taking all the materials from one of these classes?

Many farmers have only timothy hay and corn fodder for roughage, and nothing in the way of grain but corn.

3. How much in feeding value will these farmers gain for every ton of corn exchanged, at $25 per ton, for an equal weight of cottonseed meal and bran, in equal parts by weight, at $31 per ton for the cottonseed meal and $24 per ton for the bran?

PROCESS: 1 ton cottonseed meal and bran bought

$$\frac{(\$31 + \$24)}{2} = \$27.50$$

1 ton corn sold = $25.00
Loss by exchange = $ 2.50
2000 × 10.3% protein in corn (see table, page 72) = 206 lb.
2000 × 30.3% protein in cottonseed meal and bran

$$\frac{(45.3 + 15.4)}{2} = 606 \text{ lb.}$$

Excess of protein in cottonseed meal and bran = 400 lb.
$27.50 ÷ 606 = 4½¢, value of protein per pound.
400 × .04½ = $18.00, value of excess of protein.
Gain in protein from exchange = $18.00
Loss in money from exchange = 2.50
Total gain in feeding value from exchange = $15.50

QUESTION. — How is the farmer profited by the exchange besides a gain in the feeding value of these grains?

4. If a farmer who has only fodder, timothy, and corn should exchange 6 tons of his timothy hay at $21 per ton for its value in alfalfa at $15 per ton, how many tons of alfalfa would he get?

5. Alfalfa is 11.7 per cent protein, and timothy is 2.8 per cent protein. How much more protein would the farmer get from his $8\frac{2}{5}$ tons of alfalfa than from his 6 tons of timothy?

Home-grown Feeds. — The farmer should raise the feeds he requires on his own farm, as far as possible, and it is possible to produce practically all that are needed to make a balanced ration. In considering the feeding of an animal, the place to begin is always with the roughage, since the character of the roughage determines to a large extent the kind of grain it is advisable to feed.

The cheapest sources of protein are clover, alfalfa, soy bean, and cowpea hay. The use of these hays makes it unnecessary to buy any large quantities of bran, oil meal, or cottonseed meal for ordinary dairying, and makes it possible to use as the principal grain corn, which usually is the cheapest.

Some Home-grown Rations

6. A fairly good ration:

Alfalfa, or cowpea hay	15–20 lb.
Corn	8–10 lb.

Find how much of the hay and corn each a cow would consume in a month on this ration, using the maximum numbers.

7. Ration for cows giving from 20 to 25 pounds of milk per day:

10 lb. alfalfa hay	@	$15.00 per ton
10 lb. corn fodder	@	10.00 per ton
6 lb. corn meal	@	30.00 per ton
2 lb. bran	@	24.00 per ton

Find the cost of this ration by the ton.

8. Ration for 900-pound cow yielding 25 pounds of 5 % milk:

Corn silage	30 pounds
Alfalfa hay	10 pounds
Corn	6 pounds
Bran	2 pounds

Find the cost of this ration per month at prices already quoted.

The cow that does not give a good flow of milk on any one of these three rations in the early part of her milking period shows that she is not adapted, by nature, as a dairy cow, and should be disposed of.

A *larger yield* of milk is controlled by liberal feeding and care in balancing the ration.

A *better quality* of milk is controlled by the selection of the cows, and to a certain extent by the breed.

III. Succulent Feeds

The third summer condition which we need to continue throughout the winter is that of a supply of succulent feed, or feed having the property possessed by green grass. This kind of feed may be supplied by silage and root crops.

1. Ration containing succulent feed (silage).

For a 900-pound cow yielding 30 pounds of 5 per cent milk:

30 lb. silage	@ $	3.00 per ton
10 lb. clover, alfalfa, or cowpea hay	@	15.00 per ton
11 lb. grain mixture	@	30.00 per ton

Find the cost of this ration for 7 months.

A good grain mixture to be used in the above ration is composed of

Corn chop	4 parts
Wheat bran	2 parts
Linseed or cotton meal	1 part

Hay should be fed with corn silage, and those hays which naturally go with it are clover, cowpea, and alfalfa hay.

2. An acre of land will produce enough corn silage and alfalfa to keep a cow, producing 6000 to 7000 pounds of milk, a whole year without buying any feed at all. What will be the ration running the entire year (360 days), if the acre is planted in equal parts with the alfalfa and silage corn, producing at the rate of 5 tons of alfalfa and 15 tons of silage to the acre?

NOTE. — "There are instances on record where cows have produced from 8000 to 9000 pounds of milk on this alfalfa and silage ration, no grain being given at any time during the year."
— HOARD'S *Dairyman.*

3. Ration without grain. (Burkett.)

18 pounds alfalfa hay @ $15.00 per ton
35 pounds corn silage @ 3.00 per ton

Find the cost of this ration per day.

4. How do linseed meal, cottonseed meal, and gluten meal compare in protein per ton?

5. When timothy hay (2.8% protein) is $21.00 per ton, and clover hay (7.1% protein) is $15.00 per ton, in which is the protein cheaper per pound?

PROCESS: 2000 × .028 = 56 lb. protein in 1 ton timothy.
2000 × .071 = 142 lb. protein in 1 ton clover.
$21.00 ÷ 56 = 37¢, cost protein per lb. in timothy.
$15.00 ÷ 142 = 10¢, cost protein per lb. in clover.
.37 – 10¢ = 27¢ cheaper per pound in clover.

6. When linseed meal is $33 per ton, and cottonseed meal is $31 per ton, in which is the protein cheaper per pound?

7. How does a ton of bran compare with a ton of oats in feeding value, when bran is $24 per ton, and oats are $22 per ton?

8. If alfalfa (11.7 % protein) costs $ 15 per ton, what does the protein cost per pound? Would protein in the alfalfa be cheaper than in the cottonseed meal at $31 per ton?

9. A farmer feeds 10 cows 3 quarts of grain each per day, while on pasture. How much is his daily increased profit from his grain-feeding for his entire herd, if his cows give 1 pound of additional milk each, worth 4 ¢ per quart, for each pound of grain fed, at $30 per ton?

Experiments covering four years (Cornell) show that feeding grain to cows while on pasture does not pay, since each pound of grain fed brings an increase of but one pound of milk. However, these grain-fed cows during summer gave better results after grazing season was over.

Hints on Dairy Feeding

In the ration there is nothing better than the straight grains when properly combined with home-grown roughage. The feeds should be kept in the proper proportions, balanced, and each cow given all she will clean up well. There is a point at which the increase in milk ceases to pay for the increase in feed (forced feeding); this varies with different cows.

Feeding twice a day will bring better results than more frequent and wasteful feeding.

" A satisfactory ration must possess a certain bulk or volume in order to properly distend the abdomen. Without this the processes of digestion cannot proceed normally." — Henry's *Feeds and Feeding.*

The cow should be fed and milked at regular intervals by the same person. She should have kind treatment and pleasant surroundings.

Turning cows out into the yard, in winter, or giving them access to a strawstack, or a field of cornstalks, will cause them to shrink in milk.

It usually pays to keep no more stock than one can raise hay and silage for in a rather poor year. Otherwise, roughage will have to be bought in the years of scarcity and high prices.

TABLE FOR THE EXACT CALCULATION OF INDIVIDUAL RATIONS

Dry Matter, Digestible Protein, and Energy Values per 100 Lbs.

FEEDING STUFF	TOTAL DRY MATTER	DIGESTIBLE TRUE PROTEIN	ENERGY VALUE
	Pounds	*Pounds*	*Therms*
Green fodder and silage:			
Alfalfa	28.2	2.50	12.45
Clover — crimson	19.1	2.19	11.30
Clover — red	29.2	2.21	16.17
Corn fodder — green	20.7	.41	12.44
Corn silage	25.6	.88	16.56
Hungarian grass	28.9	1.33	14.76
Rape	14.3	2.16	11.43
Rye	23.4	1.44	11.63
Timothy	38.4	1.04	19.08
Hay and dry coarse fodders:			
Alfalfa hay	91.6	6.93	34.41
Clover hay — red	84.7	5.41	34.74
Corn forage, field cured	57.8	2.13	30.53
Corn stover	59.5	1.80	26.53
Cowpea hay	89.3	8.57	40.76
Hungarian hay	92.3	3.00	44.03
Oat hay	84.0	2.59	26.97
Soy bean hay	88.7	7.68	38.65
Timothy hay	86.8	2.05	33.56
Straws:			
Oat straw	90.8	1.09	21.21
Rye straw	92.9	.63	20.87
Wheat straw	90.4	.37	16.56

TABLE, ETC. — *Continued*

FEEDING STUFF	TOTAL DRY MATTER	DIGESTIBLE TRUE PROTEIN	ENERGY VALUE
	Pounds	*Pounds*	*Therms*
Roots and tubers:			
Carrots	11.4	.37	7.82
Mangel-wurzels	9.1	.14	4.62
Potatoes	21.1	.45	18.05
Rutabagas	11.4	.38	8.00
Turnips	9.4	.22	5.74
Grains:			
Barley	89.1	8.37	80.75
Corn	89.1	6.79	88.84
Corn-and-cob meal	84.9	4.53	72.05
Oats	89.0	8.36	66.27
Pea meal	89.5	16.77	71.75
Rye	88.4	8.12	81.72
Wheat	89.5	8.90	82.63
By-products:			
Brewers' grains — dried	92.0	19.04	60.01
Brewers' grains — wet	24.3	3.81	14.82
Buckwheat middlings	88.2	22.34	75.92
Cottonseed meal	91.8	35.15	84.20
Distillers' grains — dried —			
Principally corn	93.0	21 93	79.23
Principally rye	93.2	10.38	60.93
Gluten feed — dry	91.9	19.95	79.32
Gluten meal — Buffalo	91.8	21.56	88.80
Gluten meal — Chicago	90.5	33.09	78.49
Linseed meal — old process	90.8	27.54	78.92
Linseed meal — new process	90.1	29.26	74.67
Malt sprouts	89.8	12.36	46.33
Rye bran	88.2	11.35	56.65
Sugar-beet pulp — fresh	10.1	.63	7.77
Sugar-beet pulp — dried	93.6	6.80	60.10
Wheat bran	88.1	10.21	48.23
Wheat middlings (flour)	84.0	12.79	77.65

SILOS

"The silo pays for itself in two years."

TABLE SHOWING SIZE AND CAPACITY OF SILOS

OUTSIDE DIAMETER IN FEET	HEIGHT IN FEET	ESTIMATED TONS CAPACITY	ACRES OF CORN	NO. COWS THAT CAN BE FED FOR 180 DAYS
8	20	20	1⅓	6 to 8
8	30	33	2¼	8 to 10
10	24	36	2⅓	10 to 12
10	30	48	3¼	12 to 14
12	24	55	3⅔	15 to 16
12	30	75	5	18 to 20
14	24	73	5	18 to 20
14	30	100	7	24 to 26
16	30	120	8	30 to 32
18	34	175	12	40 to 42

Capacity based on 15 tons of corn per acre.

Feeding estimated at 40 pounds a day per cow.

1. What is the circumference of a round silo that is 10 feet in diameter?

PROCESS: The circumference equals the diameter multiplied by 3.1416.

2. What is the area of the floor space of a round silo 10 feet in diameter?

PROCESS: The floor space equals the square of the radius multiplied by 3.1416.

3. What is the diameter of a round silo having a floor surface of 50 square feet?

PROCESS: Divide the area by .7854 and take the square root of the quotient.

4. The estimates in the above table are for 180 days at a 40-pound allowance. For how many days would the same quantity last at a 35-pound allowance?

5. The first silo in the table requires how many acres of corn to fill it when producing 12 tons to the acre?

6. If 20 cows eat 30 pounds of silage each, per day, how many tons will it take to last them 6 months?

PROCESS:

$$20 \times 30 \times 180 = 10{,}800.$$
$$10{,}800 \div 2000 = 54 \text{ tons.}$$

The diameter of a silo must bear a certain relation to the number of head of stock fed from it.

After a silo is opened the top layer of silage spoils rapidly unless used to a depth of 2 inches or more, daily.

7. The average weight of silage is 40 pounds to the cubic foot. If a cow is fed about $33\frac{1}{3}$ pounds daily, what part of a cubic foot is this?

8. Since the least depth of silage that should be removed daily is 2 inches, and a moderate feed for a cow per day is $\frac{5}{6}$ of a cubic foot, what amount of surface silage should be provided for each cow per day?

PROCESS: $\frac{5}{6}$ (cu. ft.) $\div \frac{1}{6}$ ft. = 5 square feet.

NOTE. — It is readily seen that if a moderate daily feed per cow of $33\frac{1}{3}$ pounds uncovering 5 square feet of silage to a depth of 2 inches insures safe feeding, a feed of 40 pounds per cow, which is considered a good daily average, uncovering the same surface

(5 sq. ft.) will insure still safer feeding, as it will have a greater depth. A feed of less than $33\frac{1}{3}$ pounds per day, with a minimum depth of 2 inches, will require less than 5 square feet per cow. Hence, there is no reason for the spoiling of silage, if properly fed.

9. What is the diameter of a silo for a dairy of 9 cows, which provides a silage surface of 5 square feet per cow?

PROCESS: 9 × 5 sq. ft. = 45 sq. ft.
45 sq. ft. ÷ .7854 = 57 sq. ft.
$\sqrt{57}$ = 7.5 ft. approximately (inside measurements).
7.5 ft. + .5 ft. (thickness of sides) = 8 ft. diameter.

10. What is the required diameter of a silo for 16 cows? From the table tell what part full the silo would have to be to feed 14 cows 150 days.

11. A farmer had a silo sufficiently large for 20 cows (by the table), but he had it only $\frac{3}{4}$ full. How long would this silage last his dairy of 20 cows, if he cut the allowance to 30 pounds per day?

12. What dimensions of silo are required for silage for a dairy of 24 cows for 6 months?

PROCESS: 24 × 5 sq. ft = 120 sq. ft.
120 sq. ft. ÷ .7854 = 152 sq. ft.
$\sqrt{152}$ = 12.5 ft. approximately + .5 ft. = 13 ft. diameter.
180 × 2 in. = 360 in. = 30 ft. height.

13. Green corn cut for silage averages about 20% less in weight when cured. What weight of cured silage will 6 acres of green corn produce, averaging 10 tons per acre?

14. Silage weighs about 40 pounds to the cubic foot. How many cubic feet to a ton, at this rate?

Cost of filling Silos. — Investigations conducted by the dairy division of the United States Department of Agriculture during the past few years with 87 silos in various parts of the country indicate the cost of filling silos to be an average of 87 cents per ton, and the cost of the corn $ 1.58 per ton.

15. At the above rate, what is the cost of filling the silo in problem 13? What is the total cost of the silage crop?

16. How much will it cost to oil the surface of a silo (outside and inside) that is 30 feet high and 12 feet in diameter, with linseed oil at 80 cents per gallon, if 1 gallon covers 180 square feet, and the cost of putting it on is about $ 3.75?

NOTE. — Oil is better than paint for a silo, as it penetrates the wood better, and makes a smoother inside surface, thus allowing the silage to settle more readily.

Table of Relative Feeding Values

Energy value of various feeds in terms per 100 pounds of the feed:

Corn silage	16.56	Oats	66.27
Red clover hay	34.74	Linseed meal	78.92
Timothy hay	33.56	Cottonseed meal	84.20
Mangel-wurzels	4.62	Wheat bran	48.23
Corn	88.84		

— From Dept. of Agriculture, Farmers' Bulletin 346.

From the above table it is observed that the feeding values of silage, clover hay, bran, and corn are in the approximate value of silage 1, clover hay 2, bran 3, and corn 4.

Bulletin 292: Cost of filling Silos.

PLANTING PROBLEMS

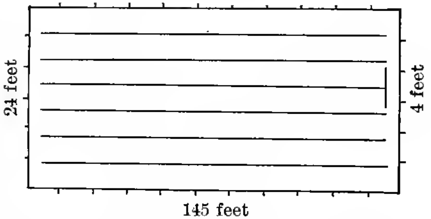
"I believe in hundred-bushel corn and fifty-bushel wheat."

An acre contains 160 square rods, or 43,560 sq. ft.

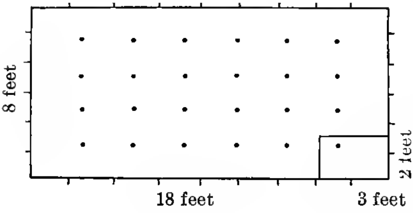
Finding Number of Rows. — To find the number of rows of corn, potatoes, trees, etc., in a rectangular field, running lengthwise, divide the width of the field, in feet, by the width of a row, in feet.

NOTE. — The width of a row is the space required for one row in growing, and is equal to the distance between the rows.

1. How many rows of strawberries, 4 feet apart and running lengthwise, in a plot of ground 145 feet long and 24 feet wide? How many rows in the same field when running crosswise?



2. How many rows in a field of corn that is 40 rods by 30 rods, the rows running lengthwise, $3\frac{1}{2}$ feet apart?



Finding Area Required. — To find the surface required by each plant or tree in a field, when planted opposite, multiply the width of a row, in feet, by the distance between the plants in the rows, in feet.

3. How much surface to one tomato plant, if the rows are 3 feet apart, and the plants are 2 feet apart in the row?

4. How much surface to one apple tree, when planted in rows 40 feet wide and 30 feet apart in the rows?

Finding Number of Plants to an Acre. — To find the number of plants or trees to the acre, divide 43,560 square feet by the number of square feet required for one plant.

5. How many tomato plants, in rows 4 feet wide, and 3 feet apart in the rows, will be required to plant half an acre?

6. How many asparagus plants will be grown on $2\frac{1}{2}$ acres, if they are set $1\frac{1}{2}$ feet apart in the rows, and the rows are 4 feet wide?

7. If a planter drops one grain of corn every foot, and the rows are 3 feet 6 inches wide, or apart, how many pounds of the ordinary corn raised in your locality will it take to the acre? What must you do before you can solve this problem?

8. When corn is checked 3 feet 6 inches apart each way, how many hills in a field containing 15 acres?

9. How many bushels of corn will it take to plant this field, if 6 grains are planted to the hill, and it measures 1100 grains to the pound?

Finding Acres in Field. — To find the number of acres in a field, multiply the length in rods by the breadth in rods, and divide the product by 160.

10. How many acres in a field that is 50 rods by 40 rods?

11. How many acres in a field that is 30 rods long, 20 rods wide at one end, and 16 rods wide at the other?

Note. — The average width of the field is 18 rods.

12. By a careful selection of his seed corn, a farmer increases his yield 6 bushels to the acre. What is the increase in value on a 15-acre field, when corn is selling at 80 cents per bushel?

Planting Table

Grains, Grasses, Etc.

Crops	Seeds or Plants per Acre	Depth of Planting	Normal Yield per Acre
Alfalfa	25 pounds, 15 to 20 drilled	¼ inch	2 to 4 tons
Clover	10 pounds with grain, 15 alone	¼ inch	2 tons
Corn	8 to 10 quarts	2 inches	50 bushels
Cotton	5 to 6 pounds; or 1 bushel drilled		1½ bales
Cowpeas	1½ to 2½ bushels	1 inch	1½ tons hay
Hairy vetch	1 bushel	1 inch	1½ tons
Hungarian grass	½ to 1 bushel	¼ inch	1½ tons
Millet	¼ to 1 bushel	¼ inch	1½ tons
Oats (spring)	2½ bushels	1 inch	35 bushels
Rice	1 to 3 bushels	1 inch	33 bushels
Rye	1 to 1½ bushels	1 inch	15 bushels
Sorghum	6 pounds, 1½ bushels	1 inch	10 tons (green)
Sugar cane	4 tons of cane		10 tons (green)
Tobacco	1 ounce	Plants	1000 pounds
Timothy	15 to 20 pounds	¼ inch	2 tons
Wheat	1½ to 2 bushels	1 inch	20 bushels

A TRUCKER'S PROBLEMS

"The farmer neither lives out of a canned garden, nor milks a tin cow."

1. What will strawberry plants for 1 acre cost at $ 5 per thousand, if they are set $3\frac{1}{2}$ feet by 18 inches?

2. How much will it cost to "set" these plants, if a man sets 2000 a day, at $1.25 per day?

3. If this acre produces 112 bushels of berries, for how much will the entire crop sell at an average price of $9\frac{1}{2}$ cents per quart? How much is this per hill?

4. At the average yield of grain per acre on your farm, as corn or wheat, at present prices, figure out how these prices would compare with the above yield of strawberries.

5. If half an acre of ground will produce 50,000 cucumbers, and these sell for pickles at $1.50 per thousand, how much is realized from the half acre, if one half is deducted for expenses?

6. After deducting one half for expenses, $18.75 was cleared from $\frac{1}{8}$ of an acre of onions, which produced at the rate of 400 bushels to the acre. At what price did these onions sell per bushel?

7. When 3800 tomato plants are set to the acre, how much surface is allowed to each plant? If the rows are 4 feet apart, how far apart are the plants in the rows?

Planting Table — Vegetables

KIND OF VEGETABLES	SEED OR PLANTS REQUIRED (100 FT. OF ROW)	DISTANCE TO PLANT APART			DEPTH OF PLANTING	NORMAL YIELD PER ACRE
		Rows Apart		Plant Apart in Rows		
		Horse Cultivation	Hand Cultivation			
Asparagus seed . . .	1 ounce	30 to 36 in.	1 to 2 ft.	3 to 5 in.	1 to 2 in.	
Asparagus plants . .	60 to 80 plants	3 to 5 ft.	12 to 24 in.	15 to 20 in.	3 to 5 in.	1,000 bunches
Beans (bush)	1 pint	30 to 36 in.	18 to 24 in.	5 to 8 to a ft.	½ to 2 in.	150 baskets
Beans (pole)	1 pint	3 to 4 ft.	3 to 4 ft.	3 to 4 ft.	1 to 2 in.	200 baskets
Beets	2 ounces	24 to 36 in.	12 to 18 in.	5 to 6 to a ft.	1 to 2 in.	6 tons
Cabbage (early) . . .	¼ ounce	30 to 36 in.	24 to 30 in.	12 to 18 in.	½ in.	8 to 10 tons
Cabbage (late) . . .	¼ ounce	30 to 40 in.	24 to 36 in.	16 to 24 in.	½ in.	
Celery	¼ ounce	3 to 6 ft.	18 to 36 in.	4 to 8 in.	½ in.	20,000 stalks
Corn (sweet)	¼ pint	36 to 40 in.	30 to 36 in.	30 to 36 in.	1 to 2 in.	4,000 ears
Egg plant	¼ ounce	30 to 36 in.	24 to 30 in.	18 to 24 in.	½ to 1 in.	800 baskets
Melon (muskmelon) .	½ ounce	6 to 8 ft.	6 to 8 ft.	Hills, 10 ft.	1 to 2 in.	
Melon (watermelon) .	1 ounce	8 to 12 ft.	8 to 12 ft.	Hills, 10 ft.	1 to 2 in.	1,200 to 1,500
Onion (set)	1 qt. of sets	24 to 36 in.	12 to 18 in.	4 to 5 ft.	1 to 2 in.	400 bushels
Onion (seed)	1 ounce	24 to 36 in.	12 to 18 in.	4 to 5 ft.	½ to 1 in.	
Peas	1 to 2 pints	3 to 4 ft.	30 to 36 in.	15 to a ft.	2 to 3 in.	200 baskets
Potato (Irish)	5 pounds	30 to 36 in.	24 to 36 in.	14 to 18 in.	4 in.	100 bushels
Potato	3 pounds	3 to 5 ft.	3 to 5 ft.	14 in.	3 in.	75 bushels
Rhubarb plants . . .	33 plants	3 to 5 ft.	3 to 5 ft.	3 ft.	2 to 3 in.	9 tons
Spinach	1 ounce	30 to 36 in.	12 to 18 in.	7 or 8 to a ft.	1 to 2 in.	350 baskets
Tomato	⅛ ounce	3 to 5 ft.	3 to 4 ft.	3 ft.	½ to 2 in.	5 to 6 tons
Turnips	½ ounce	24 to 36 in.	18 to 24 in.	6 or 7 to a ft.	¼ to ½ in.	6 tons

8. How many beets planted one foot apart can be grown on $\frac{1}{4}$ of an acre? How much can be cleared from this crop at $1.00 per hundred, after deducting $\frac{1}{3}$ for expenses?

9. When cabbage is planted 3 feet apart in the row, and in rows 4 feet apart, what is the value of what $1\frac{1}{2}$ acres will produce of early cabbage at 7 cents per head, counting $\frac{1}{4}$ of the heads out as imperfect?

Finding Area. — To find the size of any plot of ground, or field, when planted in rows of uniform length and width, multiply the width of one row, in feet, by the number of rows and this product by the length of one row, in feet, and divide the result by 43,560.

10. What area is planted in pole beans when planted in 4 rows 2200 feet long and 3.3 feet wide?

PROCESS: $3.3 \text{ feet} \times 4 \times 2200 = 29{,}040.$

$$29{,}040 \div 43{,}560 = \frac{29{,}040}{43{,}560}, \text{ or } \frac{2}{3} \text{ acre.}$$

NOTE. — In finding the width of such a plot it is a common mistake to multiply the distance between the rows by the number of spaces.

11. A patch 2200 feet long is planted in 4 rows of pole beans, rows 3.3 feet wide; 2 rows of beets, rows 2 feet wide; 1 row of egg plants, $2\frac{1}{2}$ feet wide; and 4 rows of sweet corn, rows 3 feet wide. What part of an acre is planted in each?

12. Figure out the area planted in each crop at home.

Bulletin 255: The Home Vegetable Garden.

AN ACRE OF POTATOES

"Use seed of the best variety."

1. How many seed pieces are required for an acre of potatoes when planted a foot apart in rows 3 feet apart?

2. How many bushels of whole potatoes, averaging 4 ounces to each potato, are required to plant this acre?

3. How many bushels under the above conditions are required for an acre when cut into halves? Into quarters?

4. The amount of seed cut to 2 eyes, and spaced as in problem 1, averages about 280 pieces to a peck. How many bushels at this rate are required per acre?

Question.—How do you find the results in the above problems if the seed pieces are planted 15 inches apart? 18 inches apart?

Size of Seed Piece.—In planting potatoes, the size of the seed piece which brings forth the best crop is a subject on which farmers vary widely in practice and opinion. To aid in settling this question, the State agricultural experimental stations have made numerous tests with seed pieces of different sizes, the following diagrams showing these general results.

The following tables show the comparative yield from planting different seed pieces, assuming 100 bushels as the total yield from single eyes:

Relative Total Yield (large and small)

1 eye . . 100 : ________________
2 eyes . . 121 : _____________________
Quarters . 141 : __________________________
Halves . . 167 : _______________________________
Wholes . . 196 : ____________________________________

Relative Gross Salable Yield (total less small)

1 eye . . 87 : ________________
2 eyes . . 105 : _____________________
Quarters . 123 : __________________________
Halves . . 142 : _______________________________
Wholes . . 157 : ____________________________________

Relative Net Salable Yield (marketable yield less seed)

1 eye . . 83 : _____________________
2 eyes . . 95 : __________________________
Quarters . 109 : _______________________________
Halves . . 115 : ____________________________________
Wholes . . 107 : _______________________________

— Farmers' Bulletin No. 35 : U. S. Dept. of Agriculture.

5. What size of seed piece produces the largest yield of large and small potatoes? The largest yield of large potatoes? The largest yield after deducting both small and seed potatoes?

6. When 1-eye pieces produce 100 bushels, how many small potatoes are there in these 100 bushels? How many bushels of seed?

7. If 1-eye pieces produce 120 bushels to the acre, how many of these will be large ones? How many bushels of seed are required?

Question. — Why is the net salable yield less when "wholes" are planted than when "halves" are planted?

Note. — These diagrams show the use of halves as seed pieces to be the most profitable, taking as the correct measure of profit the yield of salable potatoes less the amount of seed used. However, when seed potatoes command a very high price it is readily seen that "quarters" may be used to an advantage.

8. A farmer raised 180 bushels per acre by using 1-eye pieces in planting. What might have been his total yield by using 2-eye pieces? By using halves?

The following table, from the Tennessee experiment station, shows the largest seed potatoes to be the most productive and least profitable, while those varying in weight from one to three ounces are most profitable.

Amount of Seed per Acre	Weight of Seed Tubers	Distance planted Apart	Yield	Number of Tubers	Cost of Seed per Acre at 75¢ per Bushel	Value of Crop per Acre at 40¢ per Bushel	Balance after Paying for Seed
Bushels	*Ounces*	*Feet*	*Bushels*	*Per Acre*			
64	12–14	3	146	90,980	$48.00	$58.40	$10.40
81	10–12	2	220	135,075	60.75	88.00	17.25
66	8–10	2	195	118,102	49.50	78 00	28.50
52	6–8	2	168	115,273	39.00	67.20	28.20
37	4–6	2	158	108,908	27.75	63.20	35.45
26	3–4	2	146	104,665	19.50	58.40	38.90
18	2–3	2	141	81,328	13.50	56.40	42.90
11	1–2	2	128	67,184	8.25	51.20	42.95

9. A farmer, by putting 10 tons of manure at $2.25 per ton on an acre of potatoes, increased the yield of marketable potatoes 80 bushels over potatoes which had no manure. What is the increased value of the manure over its market value if the potatoes sell at 80¢ per bushel, and the cost of putting the manure on is $5.00?

Average Yield.—The average yield of potatoes from one plant in United States is about half a pound.

10. What is the average yield per acre in United States when potatoes are planted one foot apart in rows 3 feet apart?

11. A farmer was offered 70 cents per bushel for his crop of 160 bushels of potatoes at digging time; but he kept them until March and sold them at 75 cents per bushel. What did he gain or lose by keeping them, if they lost 10% in weight from storage?

12. A bushel of potatoes was retailed at $1.20. Of this money the retailer got 32 cents, the wholesaler 12 cents, the railroad 26 cents, the commission merchant 8 cents, and the farmer or producer what was left, or 42 cents. What per cent of the consumer's price reached the producer? What per cent of the consumer's price went to transportation and distributors?

FERTILIZERS

"Never buy a thing because it is cheap; it will prove dear to you in the end."

Soil Losses

Generally all the elements necessary to the growth of plant life are found available in the soil in sufficient quantity except three — ammonia, phosphoric acid (phosphorus), and potash (potassium). These three elements are rapidly used up by the growing and removal of crops, and in certain kinds of soil they may be wanting or unavailable.

Table showing Fertilizing Elements removed from the Soil in One Ton of Various Farm Crops

FARM PRODUCT	AMMONIA	PHOSPHORIC ACID	POTASH
	Pounds	*Pounds*	*Pounds*
Timothy hay	19.2	7.2	25.2
Alfalfa hay	53.2	10.8	49.2
Corn fodder, field cured . . .	17.2	7.2	21.4
Corn silage	8.4	2.4	6.6
Wheat straw	8.6	2.6	14.8
Wheat	34.6	19.2	7.0
Oats	36.2	15.4	11.4
Corn	29.6	12.2	7.2
Wheat bran	51.2	58.4	31.4
Cottonseed meal	142.8	61.8	36.4
Potatoes	7.0	3.2	11.4

Table from Farmers' Bulletin No. 44 : U. S. Dept. of Agriculture.

NOTE. — Many users of fertilizers are bothered by such expressions as "1.65% Nitrogen equivalent to 2% Ammonia." As used by the fertilizer trade, ammonia means about the same thing as nitrogen, a pound of nitrogen being equivalent to 1.214 pounds of ammonia. Therefore ammonia will generally be used in this book, as it is the common commercial term.

1. How much of each of these three elements is removed from the soil in producing 10 acres of wheat averaging 30 bushels to the acre?

PROCESS: 10 × 30 × 60 = 18,000 pounds.
18,000 pounds = 9 tons.
9 × 34.6 = 311.4 pounds ammonia.
9 × 19.2 = 172.8 pounds phosphoric acid.
9 × 7 = 63 pounds potash.

2. What are the soil losses in producing 1 acre of corn yielding 60 bushels?

3. How much was a boy's prize club acre taxed from which he produced 110 bushels of corn?

4. The average production of wheat in the United States for 1913 was 16 bushels per acre. Counting the weight of the straw at 1920 pounds per acre, figure out the entire loss to the soil in ammonia, phosphoric acid, and potash.

5. 100 bushels of potatoes remove what value of plant food from the soil, counting ammonia at 15 cents a pound and phosphoric acid and potash at 5 cents a pound each?

6. From the average yield of your father's corn crop for the past year, figure out the cost of plant food per acre removed from the soil at the above (Ex. 5) commercial prices.

Commercial and Home-mixed Fertilizers

The soil losses due to growing crops may be replaced by chemical fertilizers and manure. Fertilizers may be so compounded as to contain ammonia, phosphoric acid, and potash in any desired proportion. All fertilizers contain one or more of these three elements. A complete fertilizer contains all three elements and is recognized by their relative proportion.

Thus, a fertilizer designated 2–8–5 means that it contains 2 per cent ammonia, 8 per cent phosphoric acid, and 5 per cent potash, or

Ammonia	Phosphoric acid	Potash
2	8	5

Since this system of notation and arrangement is coming into general use, it will be used throughout the treatment of this subject.

What is the analysis of a fertilizer that is labeled 3–8–2? 4–8–4? 2–8–10?

Some forms of ammonia are obtained in commercial fertilizers from:

Nitrate of soda, about 18 per cent
Sulphate of ammonia, about 25 per cent
Tankage, about 8 per cent

Some forms of phosphoric acid are obtained from:

Ground bone, about 16 per cent
Acid phosphate, about 14 per cent
Basic slag, 17–19 per cent

Some forms of potash are obtained from:

Muriate of potash, 50 per cent
Sulphate of potash, 50 per cent
Kainit, 12.5 per cent

Problems

7. How many pounds of ammonia in a ton of nitrate of soda?

PROCESS: 2000 lb. × .18 = 360 lb.

8. How many pounds of actual ammonia have you applied to a field where 500 pounds of sulphate of ammonia have been used?

9. If you wish to put 70 pounds of actual potash on a piece of land, how many pounds of muriate of potash will be required? Of kainit?

> *Plant Food in Fertilizer.* — No fertilizer is composed entirely of plant food, a large part of most fertilizing materials being chiefly inert matter. For instance, in one ton of sulphate of ammonia only 500 pounds are actual plant food; the remaining 1500 pounds, while not actual plant food, may be of some benefit to the soil.

10. In a ton of 3–6–8 fertilizer, how many pounds each of ammonia, phosphoric acid, and potash?

PROCESS: 2000 × .03 = 60 pounds ammonia.
2000 × .06 = 120 pounds phosphoric acid.
2000 × .08 = 160 pounds potash.

The above process may be shortened by multiplying each figure in the formula by 20.

EXPLANATION. — Since in a ton of 3–6–8 fertilizer the 3 means that in every 100 pounds of the fertilizer there are 3 pounds of ammonia, in 1 ton or 2000 pounds of the fertilizer there are 20 × 3 pounds or 60 pounds of ammonia. There are also 20 × 6 pounds or 120 pounds of the phosphoric acid, and 20 × 8 pounds or 160 pounds of potash.

Hence, it may be seen that the number of pounds of each element in a ton of any fertilizer may be found by multiplying the respective percentages in the formulas by 20.

Thus,
$20 \times 3 = 60$ lb. ammonia.
$20 \times 6 = 120$ lb. phosphoric acid.
$20 \times 8 = 160$ lb. potash.

11. In a ton of 2–8–10 fertilizer, how many pounds of each element? In a ton of 1–8–1? Of 2–6–4? (Use short method.)

12. How many pounds each of ammonia, phosphoric acid, and potash in a 200-pound sack of 2–8–2 fertilizer?

A *low-grade fertilizer* is one that contains a relatively small amount of plant food.

A *high-grade fertilizer* is one that contains a relatively large amount of plant food.

13. The formula 1–8–2 shows a low-grade fertilizer, 2–8–3 a medium-grade, and 4–7–10 a high-grade fertilizer. Find the amount of plant food in each.

NOTE. — In many cases it is desirable to purchase the unmixed fertilizing materials, either for use singly or for home mixing. A saving may be effected (1) in the cost per pound of the constituents, (2) in freight rates, and (3) in having the mixing performed by the ordinary labor of the farm when it does not interfere with the regular outdoor work. However, for home mixing to be advisable and profitable, the farmer should not only have knowledge of the plant food required and its availability, but he needs to mix it in sufficiently large quantities to make the trouble worth while.

14. In the spring, a farmer sowed broadcast, as a top dressing, 100 pounds per acre of nitrate of soda, costing $54.00 per ton. What was the cost of a sufficient amount of this fertilizer to cover 12 acres?

15. A farmer makes a ton of fertilizer by mixing 400 pounds of nitrate of soda, 1400 pounds of acid phosphate, and 200 pounds of muriate of potash. What quantity of ammonia, phosphoric acid, and potash does he have?

16. How many pounds each of sulphate of ammonia, acid phosphate, and muriate of potash are required to one ton of potato fertilizer, 4–8–4?

PROCESS: 20 × 4 = 80 lb. ammonia.
20 × 8 = 160 lb. phosphoric acid.
20 × 4 = 80 lb. potash.
25% of sulphate of ammonia required = 80 lb.
Sulphate of ammonia required = 320 lb.
14% of acid phosphate required = 160 lb.
Acid phosphate required = 1143 lb.
50% of muriate of potash required = 80 lb.
Muriate of potash required = 160 lb.
320 lb. + 1143 lb. + 160 lb. = 1623 lb.
2000 lb. – 1623 lb. = 377 lb. filler.

The filler may consist of sand or dry dirt.

Filler is used to aid in the evenness of distribution, and to meet the demands for a low-grade fertilizer. The higher the grade of goods, the less the amount of filler.

QUESTION. — If you wish to make but 500 pounds of the above fertilizer, what part of the materials do you take?

17. How many pounds of nitrate of soda, acid phosphate, and kainit are required to make half a ton of 4–8–4 fertilizer?

The *value of a fertilizer* is determined by the amount and availability of the elements which it contains. In working the problems which follow use these prices:

Ammonia	15 cents per pound
Phosphoric acid	5 cents per pound
Potash	5 cents per pound

18. Find the value of the food elements, or intrinsic value of a fertilizer that analyzes 2–10–2.

PROCESS: 20 × 2 = 40 lb. ammonia 40 × .15 = $ 6.00
20 × 10 = 200 lb. phos. acid 200 × .05 = 10.00
20 × 2 = 40 lb. potash 40 × .05 = 2 00
Total $ 18.00

The *intrinsic value* of a fertilizer is the value of the available plant food which a plant can get from it.

The *market value* is the selling price of the fertilizer to the consumer. It represents the intrinsic value plus the cost of mixing, bagging, shipping and selling the goods, and the profit.

The *agricultural value* is the producing value. This value varies according to the availability of the plant food contained in the fertilizer, the needs of the plant, weather, and judgment in application.

19. What is the market value of a ton of potato fertilizer that analyzes 3–6–8, when the cost of putting it on the market is $ 8.00?

NOTE. — The cost of putting a ton of fertilizer on the market, including a fair profit, is rated at about $ 8.00.

20. When a salesman asks $ 38.00 for a ton of fertilizer which analyzes 6–8–2, how much is he asking for it above its intrinsic value?

NOTE. — The agricultural value of this ton of fertilizer may be more than $ 38.00 or it may be less, depending upon the conditions in its application. The farmer has no direct control of the intrinsic and the market values of the fertilizer which he buys, but he has very much to do with its agricultural value.

21. A boy found that by putting 400 pounds of fertilizer on his club acre of corn the yield was increased 20 bushels. What was the agricultural value of this fertilizer per ton, corn worth 60 cents per bushel?

22. How much does a farmer save by mixing a ton of 2–8–7 potato fertilizer when the market value of the mixed fertilizer is $ 30.00 per ton, counting labor at $ 1.00 per ton?

23. When a ton of fertilizer analyzing 2–8–2 costs $ 25.00, what is the average cost per pound of the plant food which it contains?

Process: $2000 \times .02 = 40$ lb.
$2000 \times .08 = 160$ lb.
$2000 \times .02 = 40$ lb.
240 lb. $\quad$ $ 25.00 ÷ 240 = $10\frac{5}{12}$ cts.

24. What is the average cost per pound of plant food in a 2–8–10 fertilizer costing $ 30.00 per ton?

Question. — Which fertilizer is really the cheaper, the 2–8–2 or 2–8–10?

It is not the price per ton of the fertilizer, but the price per pound of the plant food in it, which the farmer should consider before buying.

See if your father buys the low-priced, expensive fertilizers.

25. Which is cheaper to the farmer, a 1–6–1 fertilizer at $ 20.00 per ton, or a 4–8–2 fertilizer at $ 30.00 per ton?

Process: $2000 \times .01 = 20$ lb. nitrogen $\quad$ $20 \times .15 =$ $ 3.00
$2000 \times .06 = 120$ lb. phos. acid $\quad$ $120 \times .05 =$ 6.00
$2000 \times .01 = 20$ lb. potash $\quad$ $20 \times .05 =$ 1.00
Commercial value $ 10.00

$20.00 buys $10.00 worth of plant food; then $1.00 buys 50 cents worth of plant food.

2000 × .04 = 80 lb. nitrogen 80 × .15 = $12.00
2000 × .08 = 160 lb. phos. acid 160 × .05 = 8.00
2000 × .02 = 40 lb. potash 40 × .05 = 2.00
Intrinsic or commercial value $22.00

$30.00 buys $22.00 worth of plant food; then $1.00 buys 73⅓ cents worth of plant food.

The cheapest fertilizer is the one in which $1.00 buys the greatest amount of plant food; hence in this case the $30.00 fertilizer is cheaper by 23⅓ cents worth of plant food to the dollar.

26. A farmer is offered a fertilizer analyzing 2–7–2 at $24.00 per ton, or one analyzing 2–8–6 at $30.00 per ton. Which one will it be cheaper for him to buy?

QUESTION. — Can the farmer afford to buy low-priced fertilizer?

27. The following is a common form of advertising:

GUARANTEED ANALYSIS

Ammonia	4 to 6%
Available phosphoric acid	6 to 9%
Total phosphoric acid	8 to 10%
Actual potash	9 to 12%

NOTE. — When extremes of guaranteed percentages are given, it is a safe plan to use the lowest in making estimates. In the above analysis use 4–6–9.

If $36.00 is the market value of this fertilizer, is it in excess of that warranted by the guarantee?

An *available soluble fertilizer* is one which is readily taken up by the crop to which it is applied.

28. GUARANTEED ANALYSIS

Ammonia	1 to 2%
Available phosphoric acid	9 to 10%
Actual potash	1 to 2%

If $25.00 is asked for this fertilizer, is there a proper relation between the guarantee and the price asked?

29. What is the net gain in fertilizing a crop paying $100.00 per acre, if $6.00 worth of fertilizer per acre will increase the yield 25 per cent, and the cost of hauling and applying the fertilizer and harvesting the increase in yield is $3.50?

30. If the crop in the above problem pays but $20.00 per acre, will it pay to fertilize it, the other conditions remaining the same?

QUESTION. — Does it pay to fertilize land that is naturally unproductive?

FARMYARD MANURES

"The farmer's manure pile, properly cared for, is
his bank."

Barnyard manure is the most important resource for preserving the fertility of the farm, and should be carefully saved and used. It represents fertility which is drawn from the soil, and which must be returned to it if productiveness is to be maintained. The liquid portion of the manure is the most valuable part, and should be carefully saved.

Analysis and Value of Manure of Animals

Animals	Analysis per Ton			Value per Ton	Value per Year
	Ammonia	Phos. Acid	Potash		
	Per Cent	Per Cent	Per Cent		
Sheep . . .	0.768	0.391	0.591	$3.30	$ 2.00
Hogs	0.840	0.390	0.320	3.29	12.00
Cows	0.426	0.290	0.440	2.02	19.00
Horses . . .	0.490	0.260	0.480	2.21	27.00
Hens	0.80 to 2	0.50 to 2	0.80 to 9	7.07	——

In one ton of average barnyard manure there are 10 pounds of ammonia, 5 pounds of phosphoric acid, and 10 pounds of potash.

Problems

1. What is the commercial value of the plant food in a ton of manure?

See values of ammonia, phosphoric acid, and potash, under Fertilizers, page 100.

2. What is the value of the manure of a herd of 10 cows for a year, averaging 14 tons per cow, at $2.25 per ton?

3. If 60 per cent of the plant food of this manure is lost by leaching, what is the value of what is lost?

Leaching. — What is leaching? How can it be prevented? See if there is any leaching going on in your father's barnyard.

4. If 60 per cent of the value of the manure is lost by leaching, figure out how much better it will pay your father to haul and spread his manure daily through the three winter months, if no plant food is lost, counting the time of man and team at half value.

5. In experiments at the New Jersey stations, mixed solid and liquid manure exposed to ordinary leaching for one hundred and nine days lost 51 per cent of its nitrogen, 51.1 per cent of its phosphoric acid, and 61.1 per cent of its potash. What per cent of each of these elements was not lost?

6. A farmer has 4 head of horses and 15 head of cows, all of which average about 1 ton of manure per head a month during the seven winter months. If 60 per cent of this manure is lost by leaching, by the usual method of management, how long will it take the value of the manure wasted, at $2.25 per ton, to pay for a new manure pit, costing $113.20?

7. How many tons of manure will it take to equal 1 ton of commercial fertilizer, containing 4–2–4?

The following table compiled by Armsby shows the amount and value of fertilizing constituents carried away from the soil in different products:

	Pounds per Ton			Value per Ton				
	Ammonia	Phos. Acid	Potash	Ammonia	Phos. Acid	Potash	Total	Manurial Value $ 10 Worth
Meadow hay . .	20.42	8.2	26.4	$ 3.47	$ 0.57	$ 1.06	$ 5.10	$ 5.10
Clover hay . .	40.16	11.2	36.6	6.83	.78	1.46	9.07	9.07
Potatoes . . .	7.01	3.2	11.4	1.19	.22	.46	1.87	.12
Wheat bran . .	49.15	54.6	28.6	8.35	3.82	1.14	13.31	8.32
Linseed meal .	105.12	32.2	24.8	17.87	2.25	.99	21.11	7.54
Cottonseed meal	135.65	56.2	29.2	23.06	3.93	1.17	28.16	10.05
Wheat	37.53	15.8	10.6	6.38	1.11	.42	7.91	2.63
Oats	36.42	12.4	8.8	6.21	.87	.35	7.43	3.86
Corn	33.06	11.8	7.4	5.62	.83	.30	6.75	3.78
Barley	39.65	15.4	9.0	6.74	1.08	.36	8.18	3.03
Milk	10.20	3.4	3.0	1.73	.24	.12	2.09	.88
Cheese	90.60	23.0	5.0	15.40	1.61	.20	17.21	.69
Live cattle . .	53.20	37.2	3.4	9.04	2.60	.14	11.78	1.18

8. It is seen from this table that if a farmer sells a ton of wheat, he sells an amount of ammonia, phosphoric acid, and potash which it would cost him $7.91 to replace in his soil in the form of commercial fertilizer.

(*a*) If he sells this wheat at 80 cents per bushel, what amount would actually represent the net value of the transaction?

(*b*) For every $10 worth of corn the farmer sells, what value of the fertility of the soil does he sell?

(*c*) What represents the net receipts of this $10 worth of corn?

NOTE. — With the $10 worth of corn the farmer has parted with $3.78 worth of his capital; that is, of the stored-up fertility of his soil. "If he does not take this into account, he makes the same mistake a merchant would make should he estimate his profits by the amount of cash which he received and neglect to take account of stock." — ARMSBY.

9. A farmer feeds a ton of bran costing $22.00, and its feeding value is $26.00. From the above table find the actual receipts from this ton of bran.

Feeding Value. — The feeding value of a feed is the producing value, and may be more or less than the cost value.

10. If the feeding value is only $20.00 in problem 9, how is this ton of bran still profitable for the farmer? How much so?

QUESTION. — Why is the farmer not apt to realize that he makes this profit?

If the farmer, instead of selling off his crops, feeds them to live stock on the farm as far as possible, a large proportion of this fertility, as has been shown above, is retained on the farm. However, G. F. Warren's *Farm Management* states that at least one kind of grain raised on the farm should be a cash crop.

11. With milch cows which are neither gaining nor losing in weight, about 75 per cent of the fertilizing constituents of the foods are obtained in the manure. What is the fertilizing value of a ton of cottonseed meal when fed to milch cows?

QUESTION. — Why would not this full value be realized in ordinary practice?

NOTE. — Perhaps the prevalent use of commercial fertilizer has much to do with the farmer's neglect of his manure pile. As a rule, let the commercial fertilizer supplement and not entirely replace the manurial supplies of the farm.

Hints concerning Fertilizers

Properly cared for, stable manure is by all means the best remedy for poverty of the soil.

Five eighths of the plant food in manure is found in the liquid part of it, and should be carefully saved.

Through the winter haul the fresh stable manure and spread it, when practical.

Spread manure just before a rain if possible.

As a rule, it is better to manure lightly and frequently than to apply a large amount at longer intervals.

SPRAYING

> "Spraying fills the barrel with the kind of fruit that used to be on top."

Spraying is no longer looked upon as an expense, but as an investment, because it is recognized as a necessary part of the work of profitably growing fruits and vegetables.

The two classes of enemies most common to vegetation are insects and fungous diseases.

Insects are divided into two classes :

1. Biting insects, such as caterpillars, beetles, and cutworms.
2. Sucking insects, such as scale insects, of which the San José scale is the most important.

The biting insects are killed by eating poisonous sprays, such as arsenate of lead.

The sucking insects are killed by being smothered by contact sprays, such as lime-sulphur solution.

An *insecticide* is a preparation for killing insects.

Table showing Quantity of Spray per Tree

Average-size trees 8 to 10 years old	3 to 4 gallons
Average-size trees 12 to 15 years old	5 to 7 gallons
For still older trees	8 to 10 gallons
For very old trees of great height and spread of limb	12 to 15 gallons

Problems

1. How much, at 12 cents a pound for the arsenate of lead, will the spray for 48 ten-year-old apple trees cost, for codling moth or apple worm, at the rate of 3 pounds of arsenate of lead to 50 gallons of water?

2. Find the cost of spraying this orchard (problem 1) three times, both for spraying material and labor, if it requires a man and a boy half a day to make each of three applications during the season, counting the man's time and the teams at $3.00 per day and the boy's time at 75 cents per day.

3. How many bushels of the increased production of fruit, from spraying, will it take to pay for the expense of spraying the above orchard three times, at 45 cents per bushel?

> *Value of Spraying Apple Trees.* — "It has been established that by spraying, from 50 to 75 per cent of the apple crop is saved from being wormy, and that the market value of the fruit has increased from $1 to $2.50 per barrel."
>
> — Bulletin 127 : U. S. Dept. of Agr.

Strong Lime-Sulphur Wash

The strong home-made lime-sulphur solution can be made as follows:

Unslaked lime	20 pounds
Flowers of sulphur	15 pounds
Water to make	50 gallons

Dilute lime-sulphur is made from 1 gallon of the concentrated lime-sulphur to from 25 to 100 gallons of water, and from 1 gallon of home-made lime-sulphur solution to about 8 gallons of water.

4. Find the cost of sufficient strong lime-sulphur home-made solution for 30 very old apple trees requiring 12 gallons per tree, if the lime costs 3 cents a pound and the flowers of sulphur costs $2\frac{1}{2}$ cents a pound.

5. Rhode Island greening apples were sprayed with commercial lime-sulphur solution for San José scale on May 12, 25, June 14, and July 25. Out of 1743 apples only 137 were affected. What per cent of the apples were not affected?

6. When 1601 Rhode Island greenings were not sprayed, 796 apples were affected and 805 were not affected. What per cent were not affected?

Fungous diseases among plants, fruit trees, and vegetables are the result of a low form of vegetable life, known as fungi, which live upon the tissues of vegetable matter. Some of these diseases are mildew, rot, scab, etc.

A *fungicide* is a preparation for killing fungi.

7. An orchard of 40 trees is sprayed for apple scab just before the buds open, using 10 gallons per tree. The solution is 1 gallon of lime-sulphur to 8 gallons of water. If the lime-sulphur is 20 cents a gallon, and it requires a man half a day with a "one-man" spray pump to do the spraying, at $1.50 per day, what is the entire cost of spraying the orchard?

NOTE. — Endeavor to get samples of the vegetation of your neighborhood which have been affected by the insects and fungous diseases.

8. The trees of an orchard that were sprayed gave an increase of 50 per cent in quantity and 100 per cent

in quality of fruit over those that were not sprayed. What percentage of increase did these trees yield over those that were not sprayed?

Note. — Since it happens that the orchardist has but one or two of the prevalent insects and diseases to consider, many of his most serious troubles permit of control by a few well-timed applications of a combined insecticide and fungicide, such as lime-sulphur wash and arsenate of lead.

9. A dilute lime-sulphur solution is made in the proportion of 1½ gallons of lime-sulphur to 50 gallons of water, with 2 pounds of arsenate of lead. What will be the cost of mixing a tankful of 250 gallons of this solution with these materials in the above proportion at 20 cents per gallon for the lime-sulphur and 15 cents per pound for the arsenate of lead?

Most of the peach orchards in the eastern half of the United States should be given the combined treatment of self-boiled lime-sulphur mixture and arsenate of lead.

Self-boiled Lime-Sulphur Solution

Lime	8 pounds
Sulphur	8 pounds
Water to make	50 gallons

In using arsenate of lead, put 2 pounds to 50 gallons of the mixture.

10. Find the cost of self-boiled lime-sulphur mixture to spray 36 average-size peach trees, at a cost of 3 cents a pound for the lime, 2½ cents a pound for the sulphur, and 12 cents a pound for the arsenate of lead.

Remark. — For average-size peach trees about 1 gallon is required for each tree.

Question. — Why is the above spray called "self-boiled"?

Table for Spraying

FRUIT	PEST	WHAT TO USE	DILUTION	FIRST SPRAYING	SECOND SPRAYING	THIRD SPRAYING
Apple . .	Codling Moth	Arsenate of Lead Lime-Sulphur	2 to 3 lb.[1] 1½ gallons[2]	Immediately after blossoms fall	10 days later	For second brood when they appear
Apple . . .	Curculio	Arsenate of Lead	2 to 3 lb.[1]	As soon as blossoms fall	10 days later	2 weeks later
Apple . .	San José Scale	Lime-Sulphur	1 to 8 lb.	10 days after leaves have dropped in Fall	Early in Spring before leaves appear	
Apple . . .	Tent Caterpillar	Arsenate of Lead	2 to 3 lb.[1]	As insects appear	As needed	
Apple . .	Leaf Crumpler	Arsenate of Lead	2 to 3 lb.[1]	About middle of May		
Apple . . .	Bitter Rot	Lime-Sulphur	1 to 8 lb.	In dormant season	When rot appears on fruit (1 to 35)	10 days later
Apple . .	Lesser Leaf Roller	Arsenate of Lead	2 to 3 lb.[1]	10 days after blossoms have fallen	10 days later	
Apple . . .	Scab	Lime-Sulphur	1 to 8 lb.	Just before buds open	When blossoms have dropped	10 days later
Apple . .	Apple Borer	Spray roots with Lime-Sulphur				

[1] 2 to 3 pounds to 50 gallons of water.

[2] 1½ gallons to 50 gallons of water.

Table for Spraying (*Continued*)

Apple . .	Black Rot	Lime-Sulphur	1 to 8 lb.	Just before buds open	When blossoms have dropped	10 days later
Peach .	Leaf Curl	Lime-Sulphur	1 to 8 lb.	Late in March, when dormant	After buds open (1 to 100)	
Peach . .	San José Scale	Lime-Sulphur	1 to 8 lb.	10 days after leaves have dropped in Fall	Early in Spring, before leaves appear	
Peach . .	Brown Rot Leaf	Lime-Sulphur	1 to 8 lb.	Just before buds open	Just after buds drop (1 to 100)	
Pear .	Blister Mite	Lime-Sulphur	1 to 8 lb.	While trees are dormant	After foliage is out (1 to 40)	
Pear . . .	San José Scale	Lime-Sulphur	1 to 8 lb.	10 days after leaves have dropped in Fall	Early in Spring, before leaves appear	
Pear . . .	Slug	Arsenate of Lead	2 to 3 lb.[1]	When insects appear	After 10 days	
Pear . . .	Rust	Lime-Sulphur	1 to 8 lb.	Before buds open	After blossoms fall (1 to 40)	At intervals of 2 weeks
Pear . . .	Psylla	Lime-Sulphur	1 to 8 lb.	When trees are dormant	After foliage opens (1 to 40)	

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[1] 2 to 3 pounds to 50 gallons of water.

Table for Spraying (*Continued*)

FRUIT	PEST	WHAT TO USE	DILUTION	FIRST SPRAYING	SECOND SPRAYING	THIRD SPRAYING
Pear	Codling Moth	Arsenate of Lead Lime-Sulphur	2 to 3 lb.[1] $1\frac{1}{2}$ gallons[2]	Immediately after blossoms fall	10 days later	For second brood when they appear
Pear . . .	Scab	Lime-Sulphur	1 to 8 lb.	Just before buds open	When blossoms have dropped	10 days later
Plum . .	Gouger	Arsenate of Lead	2 to 3 lb.	Before leaves and buds are completely out		
Grape . . .	Flea Beetle	Arsenate of Lead	2 to 3 lb.[1]	Immediately after appearance of beetle	Whenever necessary	
Grape . .	Anthracnose	Lime-Sulphur	1 to 8 lb.	Before buds open	At intervals of 10 to 20 days	
Grape . . .	Leaf Hopper	Kerosene Emulsion	1 to 50 lb.	When insects appear on foliage	After foliage appears (1 to 50)	
Strawberry .	Slug	Paris Green	4 to 6 oz. to 50 gal.	In May	Spray for second brood in Southern States	

[1] 2 to 3 pounds to 50 gallons of water.

[2] $1\frac{1}{2}$ gallons to 50 gallons of water.

For the above table, which has been approved by the State Experimental Stations, the author is indebted to the Sherwin-Williams Company, Cleveland, Ohio.

11. It is estimated that in the peach orchards of the eastern United States an increase per tree of at least one-half bushel of good merchantable fruit, worth about 50 cents, may be obtained from spraying, at a cost of 3 to 5 cents. What is the increased profit from spraying an orchard of 100 trees, at an average cost of 4 cents per tree?

12. With the spray given in problem 9, find the cost of spraying your father's apple orchard.

Question. — Which costs more, the spray or its application to the trees?

Hints on Spraying

Spraying produces unsatisfactory results to some for two reasons:

1. Failure to make the applications at the proper time.
2. Failure to coat the trees and fruit with the mixture.

Cover every part of the tree with the "fog," but don't keep spraying until the leaves drop. Spraying is not sprinkling.

Except in spraying the tops of trees the nozzle men should never ride in the wagon, even while spraying the smallest trees. Many failures result from attempts to spray trees from the wagon as the outfit is being driven by.

Do not spray when plants are in bloom, as there is danger of injuring the blossoms and decreasing the yield of fruit.

DRAINAGE

"On soils needing drainage, no farmer can afford to be without it."

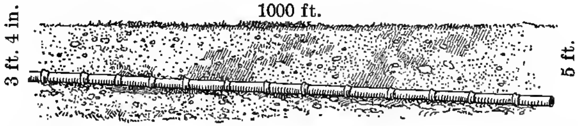
1. A piece of land which is nearly rectangular contains 5 acres and is 1000 feet long. What is the fall per hundred feet, lengthwise, if the upper end is $2\frac{1}{2}$ feet higher than the lower end?

Fall for 4-inch Tile. — For tile 4 inches and larger a fall of 3 inches to 100 feet is considered good on any ordinary soil.

2. What is the cost of laying a line of tile through the above piece of land at $25 per thousand, and 25 cents per rod for labor?

NOTE. — Tile 12 inches in length is understood in these problems, although sizes run from 12 to 30 inches in length and from 2 to 36 inches in diameter.

3. If the annual increase of crops in this land is $3 per acre, after drainage, how many years will it take for the increase to pay for the draining?

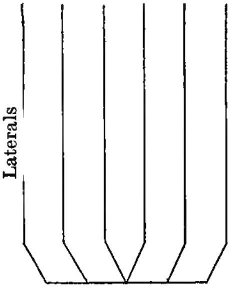


4. If there is no fall in the surface of a piece of land for 1000 feet, and a tile drain is started 5 feet deep at the outlet, how far beneath the surface will the source of the drain be, to give it a fall of 2 inches to 100 feet?

PROCESS: 1000 feet = 10 × 100 feet.
10 × 2 inches = 20 inches.
5 feet − 1 ft. 8 in. = 3 ft. 4 in.

5. In this diagram showing six lateral drains, what width of surface will they drain if placed 50 feet apart?

Laterals are placed from 30 feet to 200 feet, or more, apart, owing to conditions. A safe guide is to place them so close together that there will be no perceptible difference in the growth of crops between them.



SYSTEM OF DRAINAGE

The following are the prevailing prices of tile in the Middle West:

SIZE	PRICE PER 1000 FEET
4 inch (diameter)	$13 to $ 16
5 inch	18 to 23
6 inch	24 to 34
7 inch	34 to 48
8 inch	48 to 60
10 inch	60 to 110
12 inch	90 to 150

Prices in the East and South are about 50 per cent in excess of these, while in the Far West they are about 70 per cent higher.

6. Find the price of 4000 feet of the best 4-inch tile in New York State; in California.

Cost per Rod. — Digging the ditch and laying and priming the tile are usually figured as one operation, which is generally paid for by the rod. The number of rods laid per day is affected by the size and depth of the tile, the character of the soil, and the skill of the workmen.

7. A good workman can dig a 3-foot ditch and lay a 4-inch tile at the rate of 8 rods per day. In laying 3300 feet of drain, which will be cheaper, to employ this man by the day at $2.50 per day, or by the rod at 30 cents per rod?

8. How much will it cost to fill the above ditch with a plow, at 3 cents per rod?

9. When laterals are laid 100 feet apart it takes 436 tiles to the acre. Find the cost of these tiles at $20 per thousand.

QUESTION. — What will be the cost when laid 80 feet apart?

10. Find the entire cost of draining an acre from problems 7, 8, and 9.

11. If the above acre of land produces but 20 bushels of corn before draining, and 40 bushels after draining, the increase in production for one crop at 60 cents per bushel will pay for what part of the cost of drainage?

Capacity of Tile. — The capacity of tile to carry water varies according to the square of the diameter. Thus, 3-inch tile will carry $2\frac{1}{4}$ times as much water as 2-inch tile, since the square of 3, or 9, is $2\frac{1}{4}$ times the square of 2, or 4.

12. The capacity of a 4-inch tile is how many times that of a 3-inch tile?

13. Find the cost of laying a line of tile drain across your school ground at $22 per thousand, and 30 cents per rod for labor.

Benefits of Drainage

1. It usually increases the yield and profits of crops.
2. It makes lands that are uncertain in production produce crops every year.
3. It makes land more porous.
4. Drainage warms the soil.
5. Drainage improves the health conditions.

—Bulletin 524 : The Drainage of the Farm.

A NORMAL DAY'S WORK

A Normal Day's Work for Various Farm Operations

Implement or Occupation	Horses	Width	Hours in Field	Acres per Day
Walking plow	2	14 in. wide 6 in. deep	9.65	2.00
Sulky plow	2	16 in. wide 6 in. deep	9.65	2.31
Gang plow	4	28 in. wide 6 in. deep	9.65	4.72
Traction plow	30 horse power engine	9.7 ft. wide 4.5 in. deep	11.32	20.3
Spike tooth harrow	2	8 feet	9.65	10.8
Spring tooth harrow	2	6 feet	9.65	7.4
Disk harrow	4	8 feet	9.65	12.8
Roller	2	8 feet	9.65	13.2
Grain drill	2	6 feet	9.62	8.8
Planting cotton and corn	2	42 in.	9.67	13.6
Covering seed potatoes	1			4.63
	2		9.53	5.96
Marking rows	2	3 feet	9.53	6.81
Planting white potatoes	1 man (drop by hand)		9.53	1.98
Planting white potatoes	2 (planter)		9.53	5.48
Cultivating corn	1		9.74	4.8
Cultivating potatoes	1		9.74	4.25
Harvesting grain with binder	3	6 feet	10.33	10.96
Harvesting grain with header	6	12 feet	10.33	28.56
Corn binder	3	Yield 41–60 bu.		7.16
Cutting, shocking, and tying corn by hand	(1 man)	Yield 41–61 bu.		1.5
Tying and shocking corn after binder	(1 man)	Yield 41–60 bu.		1.5

A Normal Day's Work — *Continued*

Implement or Occupation	Horses	Yield	Hours in Field	Acres per Day
Husking from shock . .	(1 man)	41–60 bu.	9.58	Per day 45.92 bu.
Husking from standing stalks	(1 man)	41–60 bu.	9.58	85.97 bu.
Husking, hauling, and unloading (standing stalks)	(1 man)	41–60 bu.	9.58	68.05 bu.
Digging white potatoes with ordinary plow . .	2		9.58	2.73 acres
Digging white potatoes with digger	2		9.58	3 84 acres
Picking up potatoes after ordinary plow . . .	(1 man)	125 bu. per acre	9.58	Per day 76.04 bu.
Picking up after elevator digger	(1 man)	125 bu. per acre	9.58	103.76 bu.
Digging and picking up potatoes by hand . .	(1 man)	125 bu. per acre	9.58	32.31 bu.

— From Bulletin of U. S. Dept. of Agriculture, Sept. 23, 1913.

This table represents average conditions secured by a circular of inquiry mailed to 25,000 farmers selected from every state and territory. From the given conditions regarding the number of horses and men, width of rows, length of day, etc., other results may be found.

Problems

Work the following problems, taking the normal day's work for the various operations found in the above table as the standard unit.

Count the time of a man and team of two horses at $3.00 per day, and of a man alone at $1.50 per day.

1. What will be the cost of plowing a 15-acre field with a walking plow ?

NOTE. — One two-horse team is employed in these problems, unless otherwise mentioned.

2. How long will it take to harrow a 20-acre field 3 times with a spike harrow having a width of ten feet?

PROCESS: $\frac{5}{4}$ of 10.8 acres = 13.5 acres in 1 day.
60 acres ÷ 13.5 acres = 4.4 + days.

NOTE. — It is plainly seen that a harrow 10 feet wide will do $\frac{5}{4}$ as much work per day as a harrow 8 feet wide.

3. Find the cost of harrowing $7\frac{1}{2}$ acres 3 times with a spring-tooth harrow 5 feet wide.

QUESTION. — Will the cost of harrowing this field be any greater or less if two teams are employed?

4. How long will it take two men to cultivate a field of corn containing $16\frac{1}{3}$ acres?

5. A field of wheat is half a mile long and 60 rods wide. How long will it take to harvest this field with a header?

6. How much will a man earn per acre at cutting, shocking, and tying corn by hand, if it yields about 45 bushels per acre?

7. How long will it take 4 men to husk 56 acres of corn from standing stalks producing 50 bushels per acre, counting even 86 bushels as one man's work per day?

8. How many bushels of potatoes will two men dig and pick up by hand in 3 days, the yield being 125 bushels per acre?

9. In husking corn from the shock, how much will a man husk in a day of $8\frac{1}{2}$ hours, regarding "hours in field" in the table as just 10 hours?

WHAT A BOY CAN DO ON HIS CLUB ACRE

"A little land, well tilled, makes a garner well filled."

Intensive farming is farming by which small areas are brought to a very high state of productiveness.

Let the club acre be "the laboratory for the club member and the demonstration plat for the farmer."

A partial copy of the report for last year of the champion member of the Pennsylvania Boys' Corn Club is given here. Figure out this boy's profit on his acre of corn and see if you can do better next year. If you are not already a member of the Boys' Corn Club of your state, you should join it at once.

(Partial Report)

Cost, Yield, and Profit for Year

Unless otherwise authorized by the State agent, in making up the cost of your acre of corn, estimate the rent of your acre at $ 5, your time at 10 cents an hour, and the time of each horse at 5 cents an hour. Count all fertilizers at just what they cost you ; count barnyard manure at $ 2 for a two-horse wagon load of about one ton, and $ 1 for a one-horse load of about half a ton. To prepare the figures for the cost column, multiply the number of hours that you work by 10, and the number of hours that each horse works by 5.

Fill out the following items carefully.

COST OF YOUR ACRE OF CORN

	NO. OF HOURS	COST	
1. Plowing, harrowing, spading, manuring, and other work of self and team . . .	30 × .10 30 × .10		
2. Hoeing acre of corn	20 × .10		
3. Planting acre of corn (self and team) . .	6 × .10 6 × .05		
4. Cultivating acre of corn (self and team) .	30 × .10		
5. Work in gathering corn	30 × .05		
6. Estimated rent of land		5	00
7. Cost of commercial fertilizer at market price			
8. Cost of barnyard manure (see paragraph 1)		20	00
9. Cost of seed corn to plant acre . . . . . . (Give actual cost or market price)			80
10. Total cost of producing acre of corn . . .			
Estimated value of corn from acre	MARKET VALUE		
11. *a.* Number of bushels of common corn made on your prize acre 90.86			
b. Number of bushels of seed corn made on your prize acre 20.00			
c. Total number of bushels on your prize acre 110.86			
12. *a.* What was the market value per bushel of your common corn at the time you put it in the crib? . . . . 90¢	$81.77		
b. What was the market value of your seed corn at this time? $2.00	40.00		
c. What was the value of all your corn, both common and seed?[1]			
13. What was the profit on your acre of corn?[2]			
14. What was the cost of your corn per bushel?[3]			
15. What was the moisture test, per cent? . .			
	$121.77		

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[1] Multiply the number of bushels of common corn by the value per bushel, multiply the number of bushels of seed corn by the value per bushel, and add the two results.

[2] Subtract the cost of producing the corn (see paragraph 10) from the value of the corn, as given in paragraph 12 *c*.

[3] Divide the total cost by the total number of bushels.

John Yohe (age) 15 (Club member sign here)
Ellen Buffington (Give your teacher's name here)
Orvin (School)

— Bulletin 537, How to Grow an Acre of Corn.

Problems

1. The average yield of corn in the United States is 29 bushels per acre. What is John Yohe's per cent of yield on his club acre above the average yield?

2. What was the cost of producing John's corn per bushel?

3. The average cost of raising corn in United States is about 44 cents per bushel. How much cheaper than the average cost per bushel did John grow his corn?

4. In Iowa, one of the leading corn states, the average yield per acre is 44 bushels. How much is John's yield per acre above the average yield of Iowa?

5. Find out how your father's yield of corn per acre compares with the average yield in the United States. With John Yohe's yield.

WHAT A CLUB GIRL CAN DO IN HER GARDEN AND CANNERY

A partial report of a member of the Girls' Garden and Cannery Club is given here.

Club Member.— Please fill out the following report blank in full from your daily records of garden and canning club work for the past season.

Estimate of Cost

Estimate cost of your one-tenth acre as follows: Rental of land $1.00; count your own time worth 10 cents an hour; count all commercial fertilizers, team work, and hired help at actual cost, and barnyard manure at $2.00 a ton; count a good two-horse load as a ton and a one-horse load as half a ton. Estimate commercial fertilizers at cost or marketing price.

Cost of Production

1.	Rent of land (see above)	1	00
2.	Preparation of seed bed (cost of labor) 5 hrs. . .		
3.	Cost of seed or plants (seeds sent to me)		
4.	Cost of planting (labor) 15 hrs.		
5.	Cost of manure and commercial fertilizers . .	1	00
6.	Cost of cultivation (labor) 23 hrs.		
7.	Cost of gathering fruit (labor) 11 hrs.		
8.	Cost of cans, labels, and supplies	3	00
9.	Actual cost of canning work, 15 hrs.		
10.	Cost of canning outfit.		
11.	Cost of marketing canned products		
	Total cost		

Garden Receipts

1. Receipts from fresh vegetables sold	17	10
2. Receipts from canned vegetables sold		
3. Value of vegetables for home use, both canned and fresh	4	00
4. Receipts from other products, as canned fruits, berries, etc.		
5. Total value of all products (add above four items)		
6. Less total cost		
7. Net profit for year on one-tenth acre club plot		

Name, *Alberta M. Cults, Clardon, Ohio.*

Find Alberta's net profit.

FARM FINANCE

"Pay as you go."

1. When 5 per cent of the amount of tax is deducted by paying it before July 1, how much does Mr. Thrifty pay on June 25, if the amount of his tax notice is $43.75?

2. What amount of tax does Mr. Slow pay on September 25, if the amount of his notice is $13.29, and it reads, "10 per cent added if not paid before September 1"?

3. A farmer gets a bill of goods for $45, subject to a discount of "5 per cent cash within 10 days." What is the cash amount of his bill?

4. For what amount shall a farmer give his note for 90 days at 6% in order to raise $160?

PROCESS: Discount on $1 for 90 da. = $0.015.
$1 – $0.015 = $0.985, proceeds of $1.
$160 ÷ .985 = $162.44, face of note.

5. A farmer buys 10 tons of 2–8–2 fertilizer at $25 per ton, payable in 30 days. How much will he owe if this bill is not paid until 60 days after purchase, money worth 6%?

6. How much will an advertisement for farm help cost if it contains 16 words, and the rates of advertising are 30 cents for 12 words, and 2 cents for each additional word?

7. A farmer, in pricing automobiles, is offered one for $1000 payable in a year's time without interest, or 6% off for cash. Which way is better for him, money worth 6%?

8. A farmer took a note for $140, dated April 1, for 90 days. What are the proceeds of this note if he has it discounted on April 25 at 5%?

PROCESS: 90 da. – 24 da. = 66 da.
$140 × .011 = $1.54, discount at 6%.
$\frac{5}{6}$ of $1.54 = $1.28, discount at 5%.
$140 – $1.28 = $138.72, proceeds.

9. In pricing rugs, a lady found them at $3.25 each, or $6 for 2. What per cent is deducted from the price per rug if two rugs are taken?

10. Supposing you have bought 8 tons of phosphate from Harry Wayne at $26.50 per ton, write him your check for this amount on your local bank.

QUESTION. — If you do not have the money in the bank, what kind of a note will you be likely to give for the phosphate?

Write one.

11. Write Harry Wayne's receipt for the amount of the above check.

12. The terms of a sale are: Amounts over $20, one year's time at 5%, or 2 per cent off for cash. Amounts under $20, cash. A man buys a cow for $80 on time, a wagon for $40 by the cash plan, and a set of harness for $16. How much did all cost him?

13. When the terms of a sale are cash for the amounts of $20 and under, and a discount of 6 per cent for all amounts over $20, which will pay the bidder better, to bid $19.75 and pay cash, or $21 and get the discount?

14. The total sale of a farmer's equipment amounts to $2740.21. What does the auctioneer get for his pay at 1 per cent of the sales?

LABOR PROBLEMS

"Strive to earn twice what you get."

In reckoning these labor problems count 26 working days to the month, 6 days to the week, and 10 hours to the day.

1. When a man is getting $ 9 a week, how much is that a month?

2. When a man is getting $ 26 per month, how much is that per week?

3. Which is better, $ $7\frac{1}{2}$ per week or $ 30 per month?

4. One boy, Sam, engaged to work during his school vacation of three months at $ 12 per month. Another boy, Jim, is working for the same time at $ 3 per week. Which boy will earn more money during his vacation?

5. A man is offered $ 25 a month (30 days) and board by one farmer, and $ 9 a week without board by another farmer. Which is better and how much better, if his board costs him $ 3 per calendar week?

6. If you engage to work for two weeks for $ 18, and lose one day by sickness, how much money should you receive?

7. A laborer is offered $ 13 per week for 4 weeks, or $ 35 and board for the entire time. Which is better for the laborer, counting board at $ 3.50 per week?

8. Which is the better pay for the month, $ 64 for the month or $ 15 by the week?

9. A man worked from April 1 till November 15, at $ 30 per month. How much is due him at the end of this time if he lost 12 days in all and has drawn $ 100 at different times?

10. How much does a man receive for cutting 10 acres of corn checked 3 feet 6 inches apart, at 10 cents per shock, cut 10 hills square?

11. After the city laborer pays $ 4.50 per week for board and 50 cents per week for laundry, how much will he have to earn per day to have as much clear money at the end of the month as the farm laborer who works for $ 30 per month and board, including washing?

SIX WAYS FOR A FARMER BOY TO MAKE MONEY

1. A boy borrowed $6.50 from his father, without interest, and with it bought a lawn-mower. He mowed his father's lawn and three lawns in a neighboring town twice a month during the six growing months, charging his father 10 cents a time, and his neighbors 25 cents a time. What was the value of this boy's capital and receipts at the end of the season, after the mower was paid for, counting a depreciation of 10 % on the cost of it?

2. John's father allowed him 6 square rods of ground with enough strawberry plants and manure for planting it, John supplying the labor. From his crop John sold 216 quarts to the neighbors, 1 bushel for home use, all at an average price of $9\frac{3}{4}$ cents per quart. What did John realize from his crop?

3. Last year a business boy made $3.78 by clearing leaves from the lawns of a neighboring town, at 3 cents per sack. He stored these leaves away and sold them during the winter for litter at a nickel per sack. How much money did this boy make altogether?

4. During the summer a fifteen-year-old boy has an ice-cream stand on the public road at the end of his father's lane, where he sells ice cream in the evenings and on holidays. His parents supply him with materials for the ice cream at the following prices:

4 qt. milk	$.16
1 lb. sugar	.05
5 drams flavoring	.05
4 dessert-spoons cornstarch	.01
3 qt. salt	.08
25 lb. ice	.15

What is his net profit if he retails it at the rate of 6 ten-cent plates to a quart, and it increases $\frac{1}{4}$ in volume in the freezing?

5. From each of four pairs of pigeons a boy raises 2 squabs for market every 4 weeks for 9 months in the year. What is the profit on these pigeons for the year, if their keep costs $1.00 per pair and the squabs sell at 50 cents per pair?

6. The plants for an asparagus bed 5 × 8 rods cost 75 cents per hundred, and were planted in rows 4 feet apart and set $1\frac{1}{2}$ feet apart. The cost of manuring and cultivating per year for 3 years was $12. What was the profit the third year, the cost of land not counted, if 340 bunches were produced, selling at 25 cents per bunch?

SIX WAYS FOR A FARM GIRL TO MAKE MONEY

1. A girl buys strawberries from her father at market prices, lines some boxes with fancy colored paper, and then repacks her berries. She makes a "special" sale of these at an advanced price of 2 cents per quart. What is her per cent of profit when she pays 10 cents for her berries?

2. Anna's father gave her 10 hens. These hens averaged 132 eggs a year each, which she sold at an average price of 25 cents per dozen. To keep this flock a year it took 200 pounds of cracked corn at $1.50 per hundredweight; 360 pounds of wheat at $1.35 per hundredweight; 130 pounds of ground oats at $1.75 per hundredweight; and 180 pounds of beef scrap at $2.50 per hundredweight. What was Anna's net profit for the year, over cost of feed?

3. Elsie makes fudge for her brother's ice cream stand at the end of their lane, which costs as follows:

½ cake chocolate	$.09
1 cup milk	.02
$\frac{1}{10}$ pound butter	.04
2 cups sugar	.05
1 tablespoonful vanilla	.02

What is Elsie's profit on this quantity of fudge, if it makes 60 squares which she sells at 10 cents per dozen? What is her per cent of profit?

4. Sarah's father gave her a Baldwin apple tree in full bearing. Last year it bore 7 bushels of "firsts" and 2 bushels of "seconds" or culls. How much did Sarah realize from her crop if the "firsts" sold at 70 cents per basket (a basket holding $\frac{5}{8}$ of a bushel) and the culls sold at 40 cents per basket?

5. Helen was given a little heifer calf to raise and was charged only for the cost of the feed. The first year this cost was $24.58, and the second year $16.11. What was Helen's profit by selling her calf at the end of the second year for $62.00?

6. Ella gathers the eggs every day at $\frac{1}{2}$ a cent a dozen, picks berries at 1 cent a quart, sweeps the porch at 5 cents a time, and dries the dishes at 2 cents a time. How much does she earn the first week in June if she gathers 3 dozen eggs a day, picks 10 quarts of strawberries every day except Sunday, sweeps the porch 3 times a week, and helps with the dishes 2 times every day?

LABOR INCOME

“The most accurate way of measuring farm profit is on the basis of labor income, or farmer’s wages.”

“Labor income is the amount of money that the farmer has left after paying all business expenses of the farm and deducting five per cent for interest on the money invested in the farm business.”

— WARREN’S *Farm Management.*

1. A farmer has a capital of $ 8000 invested in farm and equipment, from which he in one year clears $ 900 above all expenses. What is his labor income, money worth 5 per cent?

2. A farmer has $ 10,000 invested, and his receipts above all expenses are $ 1000 for the year. What is his labor income at a 5 % rate of interest, if he has a son’s help which he values at $ 300?

3. A man having $ 2000 at interest, hired out on a farm for a year at $ 30 per month. At the beginning of the next year he invested his $ 2000 in a small farm costing $ 5000, giving a mortgage for the remainder of the cost price. Which year did he have more clear money, if he received $ 400 the second year above all farm expenses, money worth 5 %?

The method of figuring labor income is shown by the table of averages for 670 farms in Jefferson County, New York:

Average capital	$9,006.00
Average receipts	1,890.00
Average business expenses	735.00
Receipts less expenses	1,155.00
Interest at 5 per cent	450.00
Income from unpaid labor	705.00
Value of unpaid labor, except owner's	96.00
Labor income	609.00

The "average capital" includes land, buildings, stock, machinery, and cash to run the farm at the beginning of business. "Average receipts" includes any unsold products or increase in animals. "Average business expenses" does not include any personal expenses but includes the value of board furnished to hired help. "Receipts less expenses" was earned by the farmer's money and the work of his family. "Income from unpaid labor" was earned by the labor of the farmer and his family. The "Value of unpaid labor except owner's" by other members of the family would have cost about $96 if it had been hired, therefore the average farmer earned $609 as wages for his work, or labor income.

"A hired farm laborer generally gets about $350 per year, his house rent and some farm products. If the farmer's labor income is less than this amount, he had better put his capital at interest and hire out."

Labor income should not be confused with farm income.

Farm income is simply the difference between the farm receipts and the farm expenses, and represents the available cash ($1155 in the above table) for the farmer's living and savings if he has no interest to pay on his farm capital.

Labor income represents what he has earned as a result of his year's labor after the earning power of his capital has been deducted.

4. If a farmer's capital is $ 8000, his yearly farm receipts are $ 1656, and his farm expenses are $ 842, what is his farm income? His labor income?

PROCESS: $ 1656 – $ 842 = $ 814, farm income.
$ 8000 × .05 = $ 400, capital income, or earning power of farmer's capital.
$ 814 – $ 400 = $ 414, labor income, or earning power of farmer's labor.

If the farm income is less than the capital income, or interest, there will be no labor income, as labor income is the excess of the farm income over capital income.

NOTE TO TEACHER. — The teacher should economize time by giving many problems similar to the above one (4) until the terms involved are perfectly clear.

5. Mr. Brown's farm and equipment is valued at $ 12,000, and it is mortgaged at $\frac{1}{3}$ of its value. Last year his farm receipts were $ 2250, and his expenses were $ 940. What was his farm income? His labor income? How much available cash did Mr. Brown have after the interest on his mortgage was paid?

QUESTION. — Does a mortgage on the farm affect the amount of farm income? The labor income? The available cash?

6. A farmer has a farm capital of $ 20,000 with no mortgage. In a poor year his farm income was $ 1120. What was his labor income? His available cash? The earnings from the investment?

"The assertion that farmers are making large profits is often erroneous, since many live on the earnings of their investment, and not on the real profits of the farm."

HOW TO USE FARM CREDIT

"Capital is brought into existence in only one way — that is, by consuming less than is produced."

"*Credit*, like a buzz saw, is a powerful agency for good in the hands of those who know how to use it. They are about equally dangerous in the hands of those who do not understand them. Many a farmer would be better off to-day if he had never had the chance to borrow money at all, or go into debt for the things which he bought."

Farm capital consists of all the real estate, machinery, live stock, and supplies, and the necessary money with which to carry on the farm business.

Working capital is the equipment necessary to operate a farm. It is the farm capital less the real estate.

Productive articles are goods which are used to produce value; as, a mowing machine, a bushel of potatoes.

Consumptive articles are goods which are used to satisfy desires; as, a quart of strawberries, an automobile.

QUESTION. — How may a bushel of wheat be either a productive article or a consumptive article? An automobile?

Problems

1. A farmer owns 10 head of cows, averaging $70 each; 3 head of horses averaging $200; farming implements to the value of $ 400 ; and has $ 250 in bank with which to run his farm business. What is the value of his working capital ?

2. John's mother gave him a dollar, with which he bought a spade. John dug some of his mother's garden and three neighbors' gardens, working 48 hours in all at 10 cents per hour. What was the value of John's working capital and money earned if his spade had depreciated one tenth in value ?

3. George's mother gave him a dollar which he spent for confectionery.

(*a*) What was George's capital when his confectionery was all eaten ?

(*b*) Which boy spent his money for a consumptive article ?

(*c*) Which boy used his money for productive purposes ?

(*d*) Which boy's purchase consumed less than it produced ?

(*e*) Which boy became a capitalist ?

4. John Brown gets $ 30 per month and saves $ 20 of it.

(*a*) How long will it take him to accumulate $ 2000 with which to stock a farm, not counting interest ?

(*b*) How much less did John Brown consume than he produced in a month ?

(*c*) In a year ?

5. Suppose John Brown had in the beginning gotten $ 2000 on credit — that is, borrowed it — with which to stock his farm.

(*a*) How long would it take him to pay back this money if he cleared $400 per year by the use of his farm capital, interest not counted?

(*b*) Which was the quicker way for Brown to secure his capital?

(*c*) What two ways of securing capital for the equipment of a farm?

6. Farmer Short-sight borrows $1000 at 5% with which to buy a pleasure automobile. What has Mr. Short-sight's automobile cost him at the end of the first year, not counting running expenses, at a depreciation of $\frac{1}{10}$?

7. Farmer Long-sight borrows $1000 at 5% with which to buy an auto-truck for use on his farm.

(*a*) What has Mr. Long-sight's auto profited him at the end of the first year at a depreciation of $\frac{1}{10}$, and not counting running expenses, if by its use he has saved $400 in horses and wagons?

(*b*) Which farmer made a proper use of his credit?

Borrowing. — There are only two kinds of borrowing: (1) to satisfy desires; (2) to assist in production.

Which kind was Mr. Short-sight's? Mr. Long-sight's? Which kind of borrowing is a bad practice?

8. If the $100 which Farmer A borrows is spent for fertilizer which adds $125 to the value of his crop, what is the gain on his investment if he pays 6% interest? What is his rate of gain?

9. If the $100 which Farmer B borrows is spent for fertilizer which adds $75 to the value of his crop, what is the loss on his investment if he pays 4% interest? What is his rate of loss?

QUESTION. — Which is more important, to borrow money at a low rate of interest, or to invest it in such a way that the borrower will be enabled to pay back the principal?

10. Mr. Jones put a mortgage of $1000 on his farm to raise money with which to buy his daughter a piano and pay for other increased living expenses. What was Mr. Jones's indebtedness at the end of one year, money worth 6 per cent?

11. With the modern equipment of machinery, Mr. Wayne, finding his farm of 90 acres too small to cultivate to an advantage, purchased 50 adjoining acres at $60 per acre. To pay for this he borrowed the money at 5 per cent. If his first year's profits netted him $420, how much could he pay off on the principal, after paying the interest?

QUESTION. — Which of these two farmers showed good business principles and courage, and had no reason to be ashamed to borrow?

Hints on Farm Credit

DIRECTION. — Let the pupils apply these sayings to the problems that illustrate them.

Credit is a good thing for those who know how to use it.

It is good business to borrow money for productive purposes in a profitable enterprise.

Let the would-be borrower be sure that it *is* a profitable enterprise before going into debt.

In the payment of a debt it is not the interest but the principal which gives the greatest trouble.

It is generally bad policy to borrow money for the purpose of purchasing anything which will not help to pay for itself.

Let the purchase of these things be postponed until the farmer has accumulated the money out of his own earnings.

The length of time the debt is to run should have a close relation to the productive life of the improvement for which the money is borrowed.

The business ability and credit of the borrower are of even greater importance than the value of the property he may own.

— Bulletin 593.

ANIMAL UNITS

In order to have a basis for comparing the amount of live stock kept, all kinds of live stock must be reduced to some unit that can be compared. This comparison may be made on the basis of feed eaten and value of manure produced. For instance, if we call a cow a unit, then 5 hogs may be called a unit, since they eat about as much as a cow, and produce about the same value of manure.

Table showing the equivalent animal units of stock, taking the cow as the adopted unit (Burkett):

	Animal Unit — Cow
1 cow	1
2 heifers	1
1 horse	1
7 sheep	1
14 lambs	1
5 hogs	1
10 pigs	1
100 hens	1

1. From the above table tell the value in animal units of 1 heifer; of 3 heifers; of 1 hog; of 12 hogs; of 4 horses; of 3 sheep; of 14 sheep.

2. If the following stock is kept on 154 acres of land, to how many animal units is it equivalent: 3 horses; 9 cows; 1 heifer; 5 hogs; 14 pigs; 30 sheep; 25 lambs; 100 hens?

3. If there are 110 acres of crops on the above farm, how many acres are cropped to 1 animal unit?

4. A farm having 1 animal unit to each 3–5 acres of crops is considered fairly well stocked. Figure out the number of acres of land to one animal unit on your father's farm.

5. Which is more heavily stocked, a farm that has an animal unit for 4 acres, or one that has an animal unit for 6 acres?

NOTE. — "On most general farms it requires at least one animal unit for each 5 to 6 acres of crops to use up the low-grade or waste products. If animals pay well the number may be increased to one animal unit for each 3 or 4 acres of crops. But only when experience has shown animals to be very profitable should the number go beyond this. Otherwise animals will be using all the products. There will be no cash crops, and in years of shortage when crops are high, feed will have to be bought rather than sold."

The above statistics have been taken largely from Warren's *Farm Management.*

FARM ECONOMICS

As farming is a business involving both capital and labor, the farmer should receive a fair income on his investment (capital income), as well as wages for his labor (labor income).

The most important factors affecting farm incomes are: (1) Size of business; (2) Crop yields; (3) Production per cow, or other animals; (4) Diversity of business.

1. Size of Business

Most of the economies of production are dependent on the area of crops grown, and are directly related to man labor, horse labor, and machinery employed.

"Crop acres" means all acres from which crops are taken, but does not include pasture. The number of acres cropped, or crop acres, is usually about half the entire farm, or farm acres. For instance, about 80 acres are cropped of 160 farm acres.

TABLE SHOWING RELATION OF SIZE OF FARM TO MAN LABOR

(Taken from 670 farms)

FARM ACRES	AVERAGE MAN EQUIVALENT	AVERAGE CROP ACRES	CROP ACRES PER MAN	ANIMAL UNITS EXCEPT HORSES PER MAN
30 or less	1.04	14	13	3
31– 50	1.18	25	21	7
51–100	1.34	40	30	10
101–150	1.61	66	41	12
151-200	1.98	89	45	13
Over 200	2.35	134	57	15

Problems

In performing these problems, count the number of crop acres to the number of farm acres as 1 is to 2. Use the tables for approximate results.

1. Since it requires a farm of about 80 acres to contain 40 crop acres, and one man can work 30 crop acres on this farm, how much man labor will be lost if 2 men put all their time on this farm?

2. When one man can crop 45 acres, how large a farm can 2 men crop, working at the same rate, without any surplus of labor?

3. One man can do about how many times as much work on a 200-acre farm as on a 30-acre farm?

4. A farmer, finding his 100-acre farm too small for himself and son, wishes to purchase sufficient acres to insure no surplus labor. How many acres should he purchase, counting their rate of labor at 35 crop acres per man?

TABLE SHOWING RELATION OF SIZE OF FARM TO HORSE LABOR

(Taken from 1248 farms)

FARM ACRES	NUMBER OF FARMS	CROP ACRES	NUMBER OF HORSES	CROP ACRES PER HORSE
30 or less	42	14.2	1.5	9.5
31–50	64	28.4	2.3	12.3
51–100	315	46.8	3.1	15.1
101–150	364	73.5	4.2	17.5
150–200	226	98.7	5.0	19.7
Over 200	237	152.8	7.2	21.2

5. On 700 farms in Indiana, Illinois, and Iowa, the cost of man labor on farms of 40 acres and less is $10 per acre, while on farms of 120 acres and over it is $5 and less. The cost of labor on the larger farms is what per cent of the cost on the smaller farms?

Problems

1. If two horses are employed, according to the table on page 150, on a farm having 14.2 crop acres, how much surplus horse labor will there be?

2. At the rate of 15 crop acres per horse, what sized farm can 3 horses work without any surplus labor?

3. A horse can do about how many times as much work on a 200-acre farm as on a 30-acre farm?

4. A farmer finds a farm of 60 acres is too large for 2 horses and not large enough for 3 horses. How many acres shall he add to his farm that he may keep 3 horses without any surplus labor, if each horse can farm 15 crop acres?

5. In some sections of the East one horse can farm only about 16 acres, but the product is worth $\frac{1}{2}$ more than what is grown in the Mid-west, where one horse can farm 25 acres. Where could a horse produce more in value, in the Mid-west or in the Eastern section?

6. How many men and horses are required on a farm of 160 acres?

PROCESS: $\frac{1}{2}$ of $160 = 80$ crop acres.
$80 \div 45 = 2$ men with a surplus of 10 acres.
$80 \div 20$ (19.7) $= 4$ horses.
Ans. Nearly 2 men; 4 horses.

TABLE SHOWING RELATION OF SIZE OF FARM TO VALUE OF MACHINERY

(Taken from 1248 farms)

FARM ACRES	CROP ACRES	VALUE OF MACHINERY	VALUE OF MACHINERY PER CROP ACRE
30 or less	14.2	$141	$9.93
31–50	28.4	207	7.29
51–100	46.8	426	9.10
101–150	73.5	497	6.76
151–200	98.7	613	6.21
Over 200	152.8	833	5.45

Problems

1. What is the difference in value, from the above table, of machinery for a 100-acre farm and that of a 150-acre farm?

QUESTION. — Why does a farm that is half as large again cost only $\frac{1}{6}$ more in value of machinery?

2. How much less is the value of the machinery per acre on the 150-acre farm than on the 100-acre farm? Why is this?

3. Mr. A buys a 120-dollar binder for his 120-acre farm. How much does this binder cost per farm acre?

4. Mr. B buys a 120-dollar binder for his 60-acre farm. How much does his binder cost per farm acre?

It is observed that while Mr. A has to make an average of $1 from every acre of his farm to pay for his binder, Mr. B has to make an average of $2 from every acre.

5. About the same amount of machinery is required to farm 50 crop acres as 100 acres. If the value of this machinery is $400, and the annual cost of housing, repairing, depreciation, interest, oil, and insurance are 20 per cent of its value, how much is the annual cost of machinery per acre on the 50 crop acres? On the 100-crop acres?

It is thus found that farm equipment generally becomes less expensive, or costs less per acre, as the farms become larger. It is this greater cost of machinery on small farms, and the surplus machinery and labor that make it more difficult to realize a moderate profit on a small farm (50 to 80 acres), than a good profit on a fair-sized farm (160 to 200 acres).

2. Crop Yields

TABLE SHOWING RELATION OF YIELD TO LABOR INCOME, WHEN 100 PER CENT REPRESENTS THE AVERAGE YIELD OF THE REGION

PERCENTAGE YIELD	AVERAGE PERCENTAGE	NUMBER OF FARMS	LABOR INCOME
75% or less	67	58	$165.00
76% to 85%	81	60	219.00
86% to 95%	91	102	663.00
96% to 105%	101	116	570.00
106% to 115%	110	103	878.00
116% to 125%	120	66	951.00
125% and over	138	69	1090.00

Problems

1. Mr. A's neighbors raise about 100 bushels of potatoes per acre at a cost of $50.00 per acre. Mr. A with 20% more fertilizer and cultivation, on the *same kind of soil*, raises 25% more potatoes than his neighbors. If potatoes are selling at 75 cents per bushel, how much more is Mr. A's profit per acre than that of his neighbors?

2. Suppose it had cost Mr. A $20 per acre to make this increase yield of 25 bushels per acre over his neighbors' yield?

QUESTIONS. — Why does the practical farmer know that it is seldom possible to "double the crop and halve the cost"? What relation generally exists between an increase of crop and the cost of the increase?

3. Which is better, an excess yield of $10 per acre on 5 acres of the same kind of soil as the surrounding neighborhood, or an excess yield of $6 per acre on 20 acres?

QUESTION. — Which has more influence on profits, the number of crop acres, or the yield per acre?

4. If the apple crop of an entire region is double what it was last year, give two reasons why the profits will not be doubled.

3. Production per Cow

TABLE SHOWING RELATION OF RECEIPTS PER COW TO PROFITS

RECEIPTS PER COW	NUMBER OF FARMS	LABOR INCOME
$30 or less	18	$ 30.00
31 to 50	97	316.00
51 to 75	106	483.00
76 to 100	53	715.00
Over 100	33	1325.00

When any crop yield of a region is very large, it is apt to be less profitable per acre than when the yield is only one half or even one third as great. Why is this?

Problems

1. How many pounds of milk will a cow have to produce annually to make an income of $75, at $1.25 per hundredweight?

2. My neighbors' cows average 4000 pounds of milk per year, which sells at an average price of $1.25 per hundredweight. How much are they gaining or losing on their feed cost at $54 per cow?

3. If my dairy averages 6000 pounds of milk per cow, what is the average profit per cow above feed cost, if fed at the same rate and cost as my neighbors' cows?

The farmer should strive to have cows one half better than the average.

4. When the average crop of potatoes (U. S.) is 90 bushels per acre, and average price is 80 cents per bushel, which pays better, the average crop per acre, or the average cow, if it costs $50 to raise an acre of potatoes?

4. Diversity of Industry

If a farmer raises nothing but crops, he usually wastes considerable material that could be profitably used to feed animals. If he raises animals only, he spends all his time on the farm that is least likely to pay good wages.

The farmers who raise both cash crops and stock make more than those who raise all crops or all stock.

TABLE OF DIVERSIFIED FARMING RELATED TO PROFITS ON FARMS SELLING WHOLESALE MARKET MILK

PER CENT OF RECEIPTS FROM CROPS	NUMBER OF FARMS	AVERAGE AREA	LABOR INCOME
15% or less	14	209	$ 769.00
16% to 30%	28	218	1210.00
31% to 50%	25	264	1225.00

The Farmer's Catechism

Every farmer will do well to compare his farm with more successful farms, to see where his farm is unprofitable and whether it can be improved, by asking himself these questions:

1. Have I 80 to 100 crop acres? If not, can I buy or rent more land?

2. Are my crop yields 10 to 20 per cent better than my neighbors' yields who have the same soil? If not, will it not pay to improve them?

3. Are my cows at least 50 per cent better than my neighbors'? If not, how much am I losing on them per year? Shall I stop keeping cows or get better ones?

4. Am I getting at least 20 per cent of my receipts from the sale of cash crops? If not, could I make more by raising cash crops?

5. Am I getting at least 20 per cent of my money from animal products? If not, am I making good use of my low-grade farm products and am I and my horses kept well employed most of the year?

Miscellaneous Problems

Farm Economics

1. In a certain region the average corn production is about 25 bushels per acre. What per cent of increase over the usual production does one of the farmers of this region have, who, by a little more care and fertilizing, raises 30 bushels per acre?

2. When an acre produces 18 bushels of wheat, and it takes 15 of these bushels to pay for the cost of raising and marketing the acre of wheat, including $5 for rental and $2 for fertilizer, what is the per cent of profit on the investment?

3. If the farm price of wheat is 90 cents per bushel, and it costs $12 per acre to raise it, how much wheat will the crop have to produce per acre before there is any profit?

4. What is the rate of profit in the above problem (3) if the crop averages 16½ bushels per acre?

5. Find out the cost of raising your father's wheat crop per acre and the farm price of his wheat per bushel, and be able to tell him how many bushels per acre it has taken to produce this crop. Figure out similar results in other home crops.

6. If it takes 50 bushels per acre of a crop to raise 70 bushels per acre, what is the per cent of profit?

Suppose the crop makes but 40 bushels per acre?

NOTE. — In figuring such problems as the above, percentages are generally a better indication to the farmer in regard to what he is doing than dollars and cents. For instance, a profit of 3⅛ bushels of wheat to the acre, at 90 cents per bushel (problem 3), does not seem very large, but these figures, reduced to a rate of profit (23¾%), make a better showing (problem 4).

7. If one man can farm 35 crop acres, how much surplus labor is there when 2 men put all their time on 50 crop acres?

QUESTION. — Why can two men work a farm of 140 acres (70 crop acres) much more easily than one man can work a farm of 70 acres (35 crop acres)?

8. It is estimated that the average number of working hours of horses per day throughout the year (313 days) is 3.5 hours. Find the working cost of a team of horses for the year, at 15 cents per hour.

NOTE. — A farmer should look upon an idle team in the barn in exactly the same way as he looks upon a hired man asleep in the haymow.

9. The small farm of 70 acres generally requires about three horses, while the large farm of 200 acres requires but about five horses. How many more acres does one horse work on the large farm than on the small farm? On which farm is horse labor more costly?

10. If a farmer planted corn in the same 15-acre field for 5 successive years, what would be the value of this corn at 60 cents per bushel if it averaged 50 bushels per acre the first year, 48 the second, 37 the third, 26 the fourth, and 18 the fifth?

11. What would have been the value of the crops in this field for these five years if he had practiced the following rotation:

First year — corn, 50 bushels per acre, at 60 cents per bushel; second year — oats, 46 bushels per acre, at 45 cents per acre; third year — wheat, 22 bushels per acre, at 80 cents per bushel; fourth year — clover hay, 2 tons per acre, at $14 per ton; fifth year — timothy hay, 1½ tons per acre, at $18 per ton?

What is meant by rotation of crops? What advantages are gained from it?

The rotation of crops as given in problem **11** is the one most commonly practiced in the North.

THE RELATION OF CAPITAL TO PROFITS

1. Farmer A operates his farm of 178 acres, in which he has $ 30,606 invested, clear of debt. Last year this farm produced receipts to the value of $ 3076, and the expenses were $ 1138. What was Farmer A's farm income? His capital income? His labor income?

The results of such problems may be expressed thus:

Number of acres	178
Capital	$ 30,605
Receipts	3076
Expenses	1138
Farm income	1938
Capital income, or interest	1530
Labor income	408

2. Farmer B operates a rented farm of 172 acres, in which he has $ 2431 invested in rental and equipment. Last year his receipts were $ 1732, and his expenses were $ 740. What was the amount of his farm income? Of his capital income? Of his labor income?

Note. — It is observed that the renter's capital, on which his interest, or capital income, is reckoned, is the amount of his investment in rental and equipment; while the owner's capital on which his interest, or capital income, is reckoned, is the amount of his investment in real estate and equipment.

Questions. — How do Farmer A's and Farmer B's capitals compare? Which has the larger labor income for his capital? Which has more available cash at the end of the year? Why is this?

3. Mr. C, having saved $3000, invested it in a small farm and equipment. His farm income at the end of the year was $231. What was his capital income? His labor income?

NOTE. — $231 was found to be the average farm income from a number of owned farms having a capital value of $3000 or less.

4. Mr. D, having saved $3000, rented a $15,000 farm and put his $3000 into rental and equipment. This farm netted him a farm income of $1432. What was his capital income? His labor income?

5. At 5 per cent interest, what amount of interest, or capital income, does Mr. D's landlord receive? What amount does Mr. D have left for equipment of his farm?

QUESTION. — Which farmer put his small capital to a larger and more profitable use, Mr. C or Mr. D?

6. Farmer Jones owns his farm of 113 acres, having a capital value of $7074 and clear of debt. His farm income last year was $767.07. What was his capital income? His labor income?

7. Farmer Brown owns his farm of 141 acres, having a capital value of $9233, on which there is a mortgage of $2281. His farm income was $1126.65. What was his capital income? His labor income? How much available cash had he after his 5 per cent interest on his mortgage was paid?

QUESTION. — On which has a farmer the opportunity to make the larger labor income, a medium-sized farm clear of debt, or a larger farm that is partly mortgaged?

8. Jones made $767.70 available cash from $7074, and Brown made $1012.65 available cash from his investment of $ 6952. Which farmer made the greater per cent on his money?

9. A farmer had a 15,000-dollar farm and equipment clear of debt. The receipts in a bad year were $ 1100 and the expenses were $ 800. What was his farm income? His labor income? His available cash?

What is meant by the saying that a farmer "doesn't make his interest"?

10. A young man, having $ 4000, put it at interest at 5 per cent and hired on a farm for a year at $ 30 per month and board. The next year he invested his $ 4000 in a small farm and equipment, which paid him a labor income of $ 240 for his year's work. Which year did he clear more money and how much?

QUESTIONS. — If a young man has a small capital and little farm experience, had he better rent a large farm, buy a small farm, or hire out?

If he has had experience, has good judgment and a small capital, which had he better do?

The statistics accredited to the respective farmers in the above type problems are the average figures taken from a survey of nearly 300 farms in the Middle West. (See note under problem 3.) This survey establishes the following conditions:

With a fair amount of capital, it is easier to make wages and interest on the larger capital than to make wages and the smaller interest on a small capital.

Part or all of the land may be rented, or the land may be owned but mortgaged.

Tenants and part owners make more than owners, because with a given capital they have a larger business.

Any factor that enables the farm operator to get control of more capital usually results in much larger profits.

The farmers who are able to have larger farms because they borrow money, are making much better labor incomes than those who farm only as much land as they can pay for.

With an owned capital of less than $5000, those who use their money to farm as tenants are making the most.

The next most profitable way to use this amount of money is to buy a larger farm than the money will pay for, leave the balance on mortgage, and then rent additional land.

The least profitable way of using this sum of money is to buy and equip a farm so small that one is not in debt, and then not rent any land.

The stages that almost every farmer goes through in becoming a farm owner are, first, as a hired man; second, as a tenant; third, as an owner.

FARM MANAGEMENT

Problems in the Dairy

1. Mr. A put up a barn for his dairy of 20 cows, which cost at the rate of $50 per cow. The interest, depreciation, repairs, insurance, and taxes amounted to 8% of the cost of the barn. How many pounds of butter, at 30 cents a pound, would be required from each cow annually to pay for her barn rent?

2. If the milkhouse where the milk is strained is 100 feet from the cows, what is the total distance walked in milking a dairy of 20 cows in a day?

3. A farmer hauls 72 quarts of milk 3 miles to a creamery and gets $1.60 per hundredweight. What is the cost of hauling each dollar's worth of milk, or cost per cent, if the farmer's time is counted at 15 cents an hour, his one horse team at 8 cents an hour, and it requires 1½ hours to make the trip?

QUESTION. — What would the cost be if the farmer had twice as much milk? One half as much?

Find out the cost of hauling your father's milk per dollar's worth, or per cent.

Would it not be better for farmers having small quantities to take turns in hauling it?

4. In the year 1911 the average price received by farmers in Iowa for butter was 25 cents a pound. Since the cost of production of the raw materials, as corn and hay, is about 60 % higher in New York than in Iowa, what should be the average price of butter in New York in order to be as profitable as in Iowa, counting labor cost equal?

5. The average price of butter in New York in the year 1911 was 29 cents a pound. In which state was butter-making more profitable, New York or Iowa? How much more?

QUESTION. — Upon what do the profits in the different localities depend besides prices received for the different commodities?

6. How many small cows, at an average value of $ 50 each, will equal 10 large cows in value at $ 90 each?

7. Which will weigh more, 18 small cows at an average weight of 847 pounds each, or 10 large cows, averaging 1556 pounds each?

8. The average value of the butter fat of the 18 small cows was $ 114.52 per head, and the average value of the butter fat of the 10 large cows was $ 184.61 per head. Which herd produced the greater value of butter fat?

9. It was found that the 10 large cows cost about $ 300 less per year for labor, barn-room, and the like, and $ 184 less for keep. Which of these herds would be the better investment for the farmer from the standpoint of their production, labor cost, and feed values?

"Farmers are correct in their almost universal prejudice against small cows."

10. "In fairly intensive dairy sections, in regions north of Washington, cows usually eat about 1 ton of grain, 1 ton of hay, and 2½ tons of silage in a year

(4 tons of hay if no silage is fed)." What is the cost of a cow's keep per year in these regions, counting the grain at $ 28 per ton, hay at $ 15 per ton, and silage at $ 3 per ton?

Question. — Find out how the above numbers compare with your father's figures for his cows' keep, both as to quantity and cost of grain, hay, etc.

11. If a 1000-pound cow eats about $ 50 worth of feed during her milking season of 10 months, and a 1400-pound cow eats $ 80 worth in the same time, what value of feed should the large cow have per day more than the small cow?

Question. — Find out whether your father makes any difference in the amount of feed given to his large cows and small cows.

"In most tests of large numbers, the Holsteins produce the most butter, with Guernseys second, and Jerseys third. These differences are primarily due to the size of the cows. When cows of the same size are compared there does not seem to be a great difference in production."

FARM MANAGEMENT

Feeding Problems

1. "It usually requires about 10 pounds of shelled corn and 10 pounds of hay or the equivalent in other feeds to produce a pound of beef." At these figures, find the cost of fattening a steer per hundredweight, when corn is 60 cents per bushel and hay is $13.50 per ton, on the farm.

2. "On an average, it takes about 5.6 pounds of shelled corn to produce 1 pound of pork." At this rate, how many bushels of corn will it take to grow a 300-pound hog?

3. A hog loses about 25% of its weight when dressed. How much will a 300-pound hog weigh when dressed?

4. When a beef loses 40% in dressing, what is the live weight of a beef that dresses 840 pounds?

5. The average price for corn on December first for several years in Iowa has been 47 cents per bushel, and in New York 73 cents. Since it requires about 30 bushels of corn to grow a full-grown hog, in which of these states is the raising of this 300-pound hog more profitable, if the difference paid to the farmer is 1 cent more per pound in New York than in Iowa?

6. "A horse or mule usually eats about 3 tons of hay in a year, or its equivalent, and 100 bushels of oats, or its equivalent." What is the yearly cost of a horse's or mule's keep, counting the hay at $15 per ton, and the oats at 35 cents per bushel, farm values?

7. In an experiment some cows averaged 20 pounds of milk per day when fed on 10 pounds of bran per day, each. An equal number of cows averaged 10 per cent more milk per day when fed 10 pounds of ground oats each. At $1.60 per hundredweight for milk, how many per cent more profitable are the oats than the bran, if each grain is worth $24 per ton?

PROCESS: 10% of 20 lb. milk = 2 lb. milk.
10 lb. oats gain 2 lb. milk.
1 ton oats gains 400 lb. milk.
$24 gains $6.40.
Gain per cent = 26⅔ per cent.

8. Experiments have shown fodder corn and timothy hay to be about equal in feeding, pound for pound. When one acre will produce 2 tons of timothy, and one acre will produce 4.8 tons of fodder corn, how much better does the fodder corn pay per acre if it is worth $10 per ton and the farm value of the timothy is $18 per ton?

Fodder corn is green corn (stalks) from which the partly matured ears have not been separated.

Corn fodder, or stover, is dry corn (stalks) from which all the corn has been husked.

FARM MANAGEMENT

Machinery and Depreciation

Table from Minnesota Farm Bulletin, showing Average Depreciation of Machinery Per Year, based on the Original Value as 100 Per Cent

Machine	Depreciation	Machine	Depreciation
	Per Cent		*Per Cent*
Threshing outfit	12.00	Corn cultivators	7.25
Hay loaders	11.78	Corn planters	7.15
Manure spreaders	11.67	Grain drills	6.75
Corn binders	10.03	Heavy harness	6.17
Harrows	8.72	Walking plows	6.09
Sulky plows	8.42	Sleds	5.81
Reapers	8.13	Horse weeders	5.71
Grain binders	7.91	Disks	5.19
Mowers	7.80	Wagons	4.89
Hay racks	7.76	Hay tedders	4.84
Hay rakes	7.80	Fanning mill	4.58
Gang plows	7.40	Grain tanks	3.47
Gasoline engines	7.35		

Problems

1. How long will a grain drill last, according to the above table?

Process: $100\% \div 6.75\% = 15$ years, nearly.

2. A farmer bought a new binder for $120, which he uses for 2 days in the year. If the depreciation and housing of this machine per year is 10 %, and the interest on the cost price is 5 % per year, how much cheaper would it be for this farmer to hire a binder at $6.00 per day?

3. If a mowing machine having a 5-foot cutting bar cuts 7 acres of grass per day, how many acres per day can be cut by a machine having an 8-foot cutting bar?

4. A man cuts a 12-acre field of grass at the rate of 7 acres per day of 8 hours. How much will it cost to cut this grass, if the man's time is reckoned at 18 cents per hour, the team at 15 cents per hour, and the use of the machine at 20 cents per acre?

5. It is estimated that farms from 60 to 100 acres average about $341 worth of machinery. The annual cost of housing, repairs, depreciation, interest, oil, and insurance has been found by cost accounts to be about 20 per cent of the value of the machinery. What is the annual cost per acre of a 100-acre farm for the use of this machinery?

QUESTION. — Can you tell why the machinery on a 60-acre farm would cost more per acre than on a 100-acre farm?

6. If a hay tedder costs $25, how much less is its cost per acre on a 150-acre farm than on a 50-acre farm?

7. Suppose a hay tedder costing $25 depreciates 10 per cent yearly from the original cost. What is the value of a tedder at the end of 4 years?

Question. — At this rate of depreciation, in how many years will this tedder be considered worn out?

8. A farmer buys a 9-year-old horse for $150. As the yearly depreciation of horses at this age averages about 15 per cent, what is the value of this horse likely to be at the age of 13 years?

FARM MANAGEMENT

Miscellaneous Problems

1. A farm of 160 acres in the form of a square, or nearly so, is divided up as follows: Woodland, 12 acres; grass for cutting, 40 acres; pasture, 24 acres; corn, 40 acres; oats, 20 acres; meadow, 9 acres; orchard, 6 acres; buildings, truck, etc., 6 acres; waste land, 3 acres.

Draw a convenient map of this farm, with a road running through the middle of it, with the buildings all on the same side of the road.

2. The smallest farms average about 43 per cent of their capital in houses and 19 per cent in barns. What is the land investment per acre of a farm of 12 acres costing $4500?

3. When the necessary equipment and horses for a 60-acre farm will be almost sufficient for 120 acres, and when the family can do all the work on the larger farm, how will the expense and income of the larger farm compare with those items of the smaller farm?

4. A dealer in farm machinery offers the following: A plow that regularly sells for $13 at 6 per cent interest can be purchased for $12 cash. What rate of interest does the farmer really pay on the cash price, if he buys this plow on a year's time?

5. Farmer Jones now belongs to a farmers' organization which has purchased 1000 tons of unmixed

fertilizer at a cost per pound of 40 per cent less than the average cost when he used to buy the average mixture on time from his local dealer. If the average price formerly paid for the commercial fertilizer was $ 25 per ton, how much does he save by dealing through the organization, if he uses 3 tons and it costs him $ 1 per ton to mix it?

Coöperation. — What is meant by coöperation? By coöperative buying? By coöperative selling? What are the advantages?

6. A farmer took a one-horse load of produce to a city 10 miles distant, and sold it from door to door at the following prices: 10 bushels potatoes at 90 cents per bushel; 200 ears of corn at 25 cents per dozen; 3 baskets of beans at 70 cents per basket; and 8 dozen eggs, at 27 cents per dozen. If the farmer's time for the day is valued at $ 1.50, the horse's time at 80 cents, and other expenses amount to 75 cents, will it pay the farmer better to stay at home and raise more produce and sell to a local buyer who pays the following prices on the farm: potatoes, 50 cents; corn, $ 1 per hundred; beans, 50 cents; eggs, 22 cents?

NOTE. — The farmer may gain or he may lose by the above retail method, according to a number of conditions. These he needs to study well.

7. Suppose the city mechanic takes half a day of his time, worth $ 2.50 per day, to go to the above farm to purchase the following produce for his family at the above-quoted farm prices: 3 bushels potatoes; 2 dozen ears corn; 1 basket beans; and 2 dozen eggs. Will it pay him better to stay at his business and earn more money to pay the middleman's profits, if his carfare is

45 cents and he pays the above-quoted retail prices at home?

8. A ton of bran contains about 240 pounds of protein and a ton of cottonseed meal contains about 752 pounds. How much more does the farmer pay for protein per pound when he buys bran at $ 24 per ton than when he buys cottonseed meal at $ 31 per ton?

9. A house painted with pure lead and oil by a first-class painter costs $ 60.00 (material $ 20.00 and labor $ 40.00), and lasts six years; the same house painted with cheap paint and oil will cost $ 51.00 ($ 11.00 for material and $ 40.00 for labor), and may last two years. How much more will it cost per year to keep the house painted with cheap material than with the best?

10. If 109 trees can be planted on an acre when they are set 20 feet apart, how many trees can be planted on an acre when they are set 40 feet apart?

Some Old Truths for the Young Farmers

The family-sized farm, which should be 100 acres or upward, is a more efficient unit than a farm of 40 acres or less.

Poor crops that do not pay the cost of production, and the feeding of these to unproductive live stock, are common causes of farm failures.

By having several crops there is not only better distribution of labor, but the chances of total loss from crop failures are lessened.

Idle horses and idle machinery are nearly as expensive as idle men.

Farm success depends largely on keeping all the working equipment busy on paying enterprises.

A crop yield about a fifth better than his neighbors', *on the same kind of soil*, is a good standard for a farmer to work for.

The farmer must have cows much better than the average in order to make money.

Since the farmer has no power to adjust prices to business, he must adjust business to prices.

The farmer has a much fuller control of the factors that determine the production of the animals than of those that determine the crop yields.

If the farmer does his part in selection, care, and feeding, he may expect returns from his animals of nearly double the average.

The question confronting the average farmer is not so much one of production as it is of marketing.

HOME ECONOMICS

"A penny saved is a penny earned."

Figures concerning division of income are offered here for consideration. In a family of four adults 25 per cent may go for food; 20 per cent for shelter; 15 per cent for clothing; 15 per cent for operating expenses; and 25 per cent for advancement. This last division includes such items as church, clubs, magazines, music, travel, savings, and life insurance.

The simplest form of bookkeeping for the homekeeper is the best. Get any kind of blank book, put down on the left-hand page all money received; on the right-hand page all money paid; at the end of the week, or month, the total sum of the right-hand column plus the money still on hand should equal the total sum of the left-hand column.

Weekly Account

1915 RECEIPTS

Apr.	*4*	*Cash on hand*		*$ 1*	*40*
"	*6*	*Weekly allowance for living expenses*		*10*	*00*
"	*9*	*18 dozen eggs*[1]	*@ .20*	*3*	*60*
"	*11*	*Allowance for suit for Eddie*		*12*	*00*
		Total			

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[1] Mrs. Careful has full charge of the "chicken business."

1915		Expenses		
Apr.	*5*	*Collection.*	*$*	*60*
“	*7*	*Ham 12 pounds @ .18*	*2*	*16*
“	*7*	*Medicine*		*50*
“	*8*	*Butter 2 pounds @ .45*		*90*
“	*9*	*Flour*	*1*	*25*
“	*10*	*3 tickets for lecture “Acres of Diamonds”*	*1*	*05*
“	*10*	*Stationery*		*50*
“	*11*	*Fare to lecture*		*30*
“	“	*Groceries*	*3*	*20*
“	“	*Suit for Eddie*	*11*	*50*
“	“	*Collars for Eddie*		*35*
“	“	*Dishes (blue flower)*	*3*	*25*
		Balance		
		Total		

At the end of the week Mrs. Careful finds she has a balance of $1.44 on hand. Add the two columns and see if they balance.

Note.—If an account does not balance, some item has been omitted or not accurately entered.

a. Keep an account of your money received and spent during next month and see if it balances.

b. Keep an account of any private enterprise you may be carrying on at home and see if it “pays.”

c. If your mother is not keeping a household account, what reasons could you give her for starting one?

Problems

Pupils fill in blanks with current local prices.

1. How much will the homekeeper save in buying flour by the barrel at $—— per barrel, over buying the same quantity at retail in 2-pound bags at —— each?

Note. — Economy of space in small houses and flats is now advanced as the reason for buying in such small quantities. Perhaps the grocers' argument is stronger when they say that smaller packages are desired for the reason that the growing multiplicity of demands on the weekly or monthly income leaves a narrower margin for living expenses.

2. When potatoes are retailing at —— cents per quarter peck they are selling at —— cents per bushel. If none rot before used, what per cent is saved by buying them by the bushel?

Note. — "The city dweller will have to learn that when he telephones for a quart of potatoes to be delivered, what he pays the farmer for the potatoes is practically nothing. What he calls the high cost of potatoes is the high cost of delivery, bookkeeping, and telephoning. The first step in reducing the high cost of living is to buy more than a quart of potatoes at one time."

3. Mr. Thrifty lays in his coal in July for the next winter at the rate of $ —— per ton for 15 tons. His neighbor buys the same kind of coal, at retail, at $—— per ton. How much does Mr. Thrifty save by his plan?

4. When a small tin can of food sells at 30 cents per can, and a large can sells at 50 cents per can, how much is saved in buying the large can, if it contains 2 times as much as the small can? What per cent is saved?

5. A house servant is paid $—— per week, a farm hand is paid $—— per month. What is the total expense of this help per month if their board is rated at $—— per week?

6. How many tons of coal will it take for a family for the six winter months, if they keep three stoves going, and each stove averages three scuttlefuls per day, a scuttleful weighing eighteen pounds?

7. In the last decade there was an increase of nearly 25 per cent in the population of United States, while the number of beef cattle decreased 20%. How does the per cent of beef for each person at the end of the last decade compare with the per cent at the beginning of it?

PROCESS: 100% + 25% = 125%, or $\frac{5}{4}$ population.
100% − 20% = 80% beef cattle.
$\frac{4}{5}$ of 80% = 64% beef.

8. A pound of beef that was worth 25 cents at the end of the last decade, was worth how much at the beginning of it?

QUESTIONS. — What two facts have acted together to cause the advance in the cost of beef? How has this affected the price of all meats?

9. Mrs. Wasteful bought a "quarter" of onions for dinner. She cooked $\frac{2}{3}$ of these and the remainder sprouted and went to waste; $\frac{2}{3}$ of those cooked were eaten, and the remainder were thrown out. What per cent of the onions bought were eaten? What per cent were wasted?

10. The baker makes about 315 five-cent loaves of bread from a barrel of flour. When flour is $6.50 per barrel, how much does the housewife save per barrel by doing her own baking, not counting time and fuel?

11. A person, in breathing, uses about 500 cubic feet of air per minute. How many times will 2 persons rebreathe the air in a room 12 feet wide, 16 feet long, and 9 feet high, during the night (8 hours) if the room has no ventilation?

12. Which is cheaper per year, dollar shirts that last 6 months each, or seventy-five-cent shirts that last 4 months each?

13. A 16-dollar suit of clothes will generally last a boy twice as long as a 10-dollar suit. Which suit is cheaper in the end, and how much?

14. A quart of milk supplies as much of both protein and energy as three-quarters of a pound of beef, or 8 average eggs. When milk is 8 cents a quart, beef 20 cents a pound, and eggs 24 cents a dozen, what per cent is saved by buying milk instead of the meat? Instead of the eggs?

15. When porterhouse steak sells at 32 cents a pound, round steak sells for about 28 cents and chuck rib for 15 cents. Of the steaks, about one-twelfth of each is waste, and one-half of the chuck rib is waste. At these prices how much does the housewife really pay for the edible portion of these meats per pound?

The following estimates may help the young home-keeper in cooking to determine the quantity needed:

Asparagus, 1 bunch	will serve	4 people
Beets, 1 bunch	will serve	6–8 people
Cabbage, solid head	will serve	8 people
Celery, 1 head	will serve	8–12 people
Chicken, 4 lb.	will serve	6 people
Corn, 1 dozen,	will serve	6 people
Eggplant (medium)	will serve	6–8 people
Greens, 1 peck	will serve	6–8 people
Onions, 1 quart	will serve	4–6 people
Parsnips, 2 (1 lb.)	will serve	4–6 people
Lima beans, 1 qt.	will serve	6 people

Peas, 1 peck	will serve	4–6 people
Potatoes, ¼ peck	will serve	8 people
String beans, 1 quart	will serve	4 people
Tomatoes, 1 quart	will serve	6 people
Turnips, ¼ peck	will serve	8 people
Soup oysters, 1 pint	will serve	2 people
Roast of beef, 4 lb.	will serve	8–10 people

Plan a dinner for 6 persons from a suitable number of the above articles at present local prices, and find the total cost.

CONCRETE

The five proofs that concrete is the best building material are these: 1. Fire proof. 2. Water proof. 3. Wind proof. 4. Vermin proof. 5. Time proof.

Proportions. — The proportions of the materials which have been found to produce satisfactory results under average conditions are: one part cement, two parts sand, and four parts crushed stone or gravel (expressed 1 : 2 : 4). However, a mixture of 1 : 2 : 3 is used for such constructions as one-course floors and walks, fence posts, water troughs, tanks, etc.

Problems

1. Find the cost of a concrete corncrib floor that is 20 feet long by 6 feet wide, at 12 cents per square foot.

2. If the above floor makes a saving of 10 bushels of corn a year, worth 60 cents per bushel, farm price, how many years will it take the corn saved to pay for the concrete floor?

3. Find the dimensions of a cubical cistern that will hold 128 barrels of water. (See table, p. 189.)

4. What is the cost of the materials required for the above cistern at the following prices:

Screened gravel or crushed rock . .	8 cu. yd. @	$1.10
Sand	4 cu. yd. @	1.00
Portland cement	14 bbl. @	2.50

5. The total cost of putting down a concrete walk 4 inches thick is about 10 cents per square foot. Find the cost of making a concrete walk 4 feet wide, from the front steps to the road, the distance being 60 feet.

6. The cost of a concrete silo is about $2.50 for each ton's capacity. What is the cost of a silo of 36 tons' capacity that will hold enough silage to last 10 cows 180 days?

7. A concrete henhouse is built 12 feet wide and 30 feet long, with walls 5½ feet above ground and 2 feet below, and 8 inches thick. How many chickens will this house hold, allowing 5 square feet of floor space to each chicken?

8. How much will it cost to build this henhouse at the following figures:

16 cubic yards of gravel	at $0.50
15½ barrels cement	at $1.50
4 men's labor for 3 days	at $1.50

A quick and effective way of cleaning a concrete henhouse is to spray it with oil and set fire to it.

Ask your father if a wooden henhouse of the same dimensions as the above concrete one can be built for the same amount of money.

9. Find the cost of a 10-foot concrete pig trough at 25 cents per linear foot.

10. How much more will concrete posts cost for a wire fence around a field that is 40 rods by 60 rods, placed 15 feet apart, at $23.50 per hundred, than the same number of wooden posts at $15.00 per hundred?

Why will the concrete posts be much cheaper in the long run?

CARPENTRY ON THE FARM

"A stitch in time saves nine."

Lumber is measured by the board foot, which is a board 1 foot long, 1 foot wide, and 1 inch thick. Thus, a board 10 feet long, 1 foot wide, and 1 inch thick contains 10 board feet, or "10 feet" (board measure); but if the board is 10 inches wide, it contains $10 \times \frac{5}{6} \times 1$ or $8\frac{1}{3}$ feet. Hence, to find the board measure of lumber, multiply the length and width expressed in feet by the thickness in inches.

1. Find the cost of the following:

9 planks, 12 ft. long, 9 in. wide, 2 in. thick.
(Expressed 2 × 9 – 12) at $25 per thousand[1]
16 planks 3 × 12 – 16 @ $26 per M.
20 joists 2 × 4 – 20 @ $29 per M.
40 joists 3 × 8 – 18 @ $27 per M.
8 beams 10 × 12 – 15 @ $28 per M.
80 boards 1 × 8 – 16 @ $22 per M.
6 boards $\frac{3}{4}$ × 6 – 16 @ $30 per M.

2. A farmer wishes to make a bin in a space that is 10 feet long and 8 feet wide. How deep shall he make it in order to hold 400 bu. of grain?

SUGGESTION. — $\frac{5}{4}$ of the number of bushels equals the number of cubic feet.

---

[1] *Example:* $2 \times \frac{3}{4} \times 12$ feet = 18 feet.
9 × 18 ft. = 162 ft. = .162 M.
.162 × $25 = $4.05.

3. How much will it cost to fence one acre that is 10 × 16 rods with a fence 4 boards high, the boards being 1 × 8 – 12, @ $24 per M, and posts 11 feet apart, costing $20 per hundred?

> *Shingles.* — In roofing, a square containing 100 square feet is the unit of measure. Shingles are 16 inches long and 4 inches wide, and when laid $4\frac{1}{2}$ inches to the weather, each shingle covers $4 \times 4\frac{1}{2}$ or 18 square inches. $144 \div 18$ or 8 shingles will cover 1 square foot, and 800 shingles will cover a square.

4. How many thousand shingles are required to roof a house 40 feet long, each side of the roof being 15 feet from the ridge to the eaves and extending one foot at each gable end?

5. How many shingles are required for a barn 50 feet long, the rafters being 20 feet long, and the shingles laid 4 inches to the weather?

6. Measure your corncrib or woodhouse at home, and estimate the cost of the lumber in it at the price of lumber per thousand in your locality.

7. A well-ventilated poultry house requires at least 30 cubic feet of space to a fowl. How high must a house be made for 30 fowls if it is 15 feet long and 10 feet wide?

8. A poultry house is 10 feet by 20 feet, 4 feet high at the eaves, and $6\frac{1}{2}$ feet high at the center of a double pitched roof. How many feet of 1-inch boards will it take to build this house, including a board roof which is 7 feet from eaves to ridge, and extends 6 inches at each gable end?

9. Fifty fowls is a safe number to be kept in one building with 5 square feet of floor space to each fowl. With these conditions, how long would a building be that is 14 feet wide, with a roof having a single pitch, 8 feet from the ground in front, and 4 feet at the back?

10. For windows in a poultry house, 1 square foot of glass surface should be allowed to about 18 square feet of floor space. At this rate how many lights, 10 by 12 inches, will be required for the above poultry house?

11. The cost of a henhouse ought not to exceed $1 per hen. If a farmer puts up a house for his flock of 50 hens at this rate of cost, what will be the annual house rent per hen at 10 per cent a year on the cost of the house for interest, depreciation, insurance, and taxes?

12. Find the cost of this farm equipment of necessary tools at these average prices:

Ax ($4\frac{1}{4}$ lb.), $1.25; hatchet, $.75; handsaw (26 in.), $1.65; steel square, $1.25; drawing knife, $1.00; brace and (12) bit, $5.00; screwdriver, $.50; jack plane (14-inch), $1.50; smoothing plane, $1.25; wood chisel, $1.00; claw hammer, $.75; spirit level (pocket size), $.20; monkey wrench (12-inch), $.60; files (flat), $.35, (three-cornered), $.15; crowbar (20 lb.), $1.25; folding rule, $.35.

FARM PASTIMES

"Don't waste your leisure time."

The Athletic Badge Test for Boys

The Playground and Recreation Association of America has adopted the following as standards which every boy ought to be able to attain:

First Test

Pull up (chinning)	4 times
Standing broad jump	5 ft. 9 in.
60-yard dash	$8\frac{3}{5}$ seconds

Second Test

Pull up (chinning)	6 times
Standing broad jump	6 ft. 6 in.
60-yard dash	8 seconds
Or 100-yard dash	14 seconds

Third Test

Pull up (chinning)	9 times
Running high jump	4 ft. 4 in.
220-yard run	28 seconds

These tests are open to all boys of America, and no age or weight limit is fixed. Any boy may enter any test at any time, and he may receive a bronze badge for passing each test by addressing the above Association at 1 Madison Square, New York City.

Problems

1. How far does a boy run in a second in the first test? How much faster does a boy run in the third test than in the second test?

NOTE. — Many farm boys are practicing for these tests at home.

2. W. A. Williams swam 15 miles in 4 hours 30 minutes. At what rate per hour was this?

3. A boy, skating at the rate of 1 mile in 12 minutes, skated up the river and back in half an hour. How far up the river did he go?

4. Jeannette and her brother took music lessons for 2 quarters at $10 per quarter each, with a deduction of 50 cents for every lesson missed. What was the amount of their bill, if each missed 3 lessons?

5. If every boy and girl averages 30 minutes per day, reading every day in the year excepting in the 3 summer months, how many days of 8 hours each will this equal for each boy and girl?

6. A plot of ground for a set of croquet should be at least 50 feet long and 30 feet wide. What part of a quarter acre is this?

HANDY FARM MEASURES AND DEFINITIONS

1 level bushel (as wheat or shelled corn) = $1\frac{1}{4}$ cubic feet, or 2150.42 cubic inches.

1 heaped bushel (as potatoes or apples) = $1\frac{1}{3}$ cubic feet.

1 bushel of shelled corn = $2\frac{1}{2}$ cubic feet of ear corn.

1 ton of new hay = 500 cubic feet.

1 ton of settled hay = 350 cubic feet.

1 barrel of water = about 4 cubic feet.

1 cubic foot of water weighs $62\frac{1}{2}$ pounds.

1 gallon = $\frac{1}{8}$ of a cubic foot (nearly).

1 acre = 43,560 square feet or 160 square rods.

1 mile = 5280 feet or 1760 yards.

The *gross weight* of anything is its own weight plus the weight of the box, barrel, or wrappings that contain it.

The *net weight* of anything is its gross weight minus the weight of the box, barrel, or wrappings that contain it.

The net profit on a farm product is its selling price minus the cost of producing and marketing it, when this cost is less than the selling price.

Buying or selling at wholesale means dealing in large quantities; as apples by the barrel.

Buying or selling at retail means dealing in small quantities; as apples by the half peck.

Farmers' Measures in General Use

1 bushel of wheat = 60 lb.
1 bushel of beans = 60 lb.
1 bushel of clover seed = 60 lb.
1 bushel of potatoes = 60 lb.
1 bushel of shelled corn = 56 lb.
1 bushel of ear corn = 70 lb.
1 bushel of rye = 56 lb.
1 bushel of barley = 48 lb.
1 bushel of oats = 32 lb.
1 barrel of flour = 196 lb.
1 barrel of beef or pork = 200 lb.

ANSWERS

Percentage — Page 16

1. 15 days
2. 199.89 lb.
3. 3.41 %
4. 15,000 lb.
5. 24 cents
6. $88\frac{8}{9}$ %
7. 20 %
8. 90 ; 8.568
9. $4.7\frac{2}{3}$ %

Farm and Market Values — Page 18

1. $ 12
2. 15 cents
3. 30 cents ; 15 cents
4. $ 120
5. $ 4
6. 40 cents
7. $23\frac{3}{4}$ cents ; $5\frac{3}{4}$ cents
8. $ 27

The Cost of Farm Crops — Page 21

1. 6 days ; $ 21
2. 2 days ; $ 7
3. $\frac{3}{5}$ day ; $ 2.10
4. 1 day ; $ 3.50
5. 8 days ; $ 28
6. 4 days ; $ 6
7. $ 28.80
8. $ 96.40
9. $ 60
10. $ 207.40 ; $ 17.28
11. $ 432
12. $ 75.60
13. $ 300.20

Harvesting Problems — Page 23

1. $ 30
2. $ 63.45
3. 28 bu.
4. 32 bu.
5. $ 119.70 ; 9 cents, nearly
6. 1280 bu.
7. 39+ tons
8. 9.4 feet
9. 3555 hills
10. 10,665 stalks
11. 106.65 bu.
12. The former, by 17.8 bu. per acre
13. Answers will differ

Farm Estimates — Page 25

1. 264 bu.
2. 384 bu.
3. 480 bu.
4. Answers will differ
5. 135 bu.
6. 918 bu.
7. 32 tons
8. Answers will differ
9. 900 gal.
10. 1080 gal.
11. 36 ft.
12. 15.708 ft.
13. 3906.25 lb.
14. $15\frac{5}{8}$ bbl.

Shipping Problems — Page 29

1. 144 boxes 2. 258 bags 3. \$80
4. 200 baskets; 125 baskets; 100 baskets
5. \$40 6. 2 times; 200% 7. \$37.50
8. \$120 gain 9. 75 cents; 100% gain 10. 63 cents loss
11. 80 cents 12. \$0.295 13. 25%
14. \$4 15. \$30; $13\frac{1}{3}\%$

Scale Tickets — Page 33

1. \$173.57 2. \$121.52 3. \$98.70
4. \$33.18 5. \$167.23 6. \$156.50

Some Market Conditions — Page 35

1. 50 cents 2. 65 cents 3. About $14\frac{2}{7}\%$
4. \$2.20 5. $26\frac{2}{3}\%$ 6. 20%
7. \$1.50 8. \$3.00; \$4.50 9. \$100; \$60; \$1840
10. 60% 11. $166\frac{2}{3}\%$ 12. 10%
13. \$3 14. \$2.40; 90 cents 15. $266\frac{2}{3}\%$; $166\frac{2}{3}\%$
16. 200% 17. $113\frac{1}{3}\%$ 18. $357\frac{1}{7}\%$
19. 140% 20. 300% 21. 500%
22. $33\frac{1}{3}$; $41\frac{2}{3}\%$; 25%

Poultry Problems — Page 40

1. \$4.17 2. Answers will differ 3. $122\frac{6}{7}\%$
4. \$2.92 5. 21 cents 6. 15 cents more per hen in Mid-west
7. \$16.50 8. $8\frac{1}{2}$ cents 9. \$11.20
10. 5% 11. $3\frac{1}{3}\%$ 12. \$13.58
13. Hens better by \$8.70 14. 4% 15. 60%
16. 30 doz.; 72 doz.; 6 doz.; 4.8 doz.
17. 32 cents 18. 30%, nearly; $66\frac{2}{3}\%$

Poultry Feeding — Page 49

2. \$1.91 3. \$2.16; 18 cents 4. \$3.52

Shipping Eggs by Parcel Post — Page 51

1. 9 cents 2. 16 cents; 26 cents 3. 52 in.; 72 in.
4. 60 in.; 43 in. 5. No 6. 2 cents; $\frac{2}{5}$ cent
7. $8\frac{1}{2}$ cents 8. $3\frac{4}{5}$ cents

Dairy Problems — Page 54

1. $25\frac{1}{2}$ lb.
2. 7.84 qt.
3. 4612 lb.
4. 4.43 lb.
5. 209 lb.
6. The latter one
7. The latter one
8. $74.36
9. 434 lb.
10. $93.38
11. $3.71
12. $186\frac{2}{3}$ lb.
13. 5779 lb.
14. 72 cents
15. $1 profit
16. $19 profit
17. Expense $4.20 greater
18. $74
19. $61.74
20. 420 lb.
21. Answers will differ
22. Answers will differ
23. Milk better by $1.30
24. .5 lb.; 2 lb.; 8 lb.
25. $108
26. $80.24
27. 1032 lb.
28. 4.44 %

Bacteria in Milk — Page 61

1. 22,700
2. 2,048,000

Cost of Raising a Dairy Cow — Page 63

1. 2,718,706
2. 21.6 %
3. $12.03
4. $11.49
5. $8.47
6. $10.75
7. $12.95
8. $4.06
9. $4

Dairy Feeding — Page 67

I. Palatable Food

1. $\frac{3}{4}$ of it
2. 8 qt.
3. 2 cents
4. 13 cents
5. 23 cents
6. $7.51
7. 12 lb. hay
    30 lb. silage
    10 lb. grain
8. $8.55

II. A Balanced Ration

1. $50.18
2. Rations will differ
3. $15.50
4. $8\frac{2}{5}$ tons
5. 1629.6 lb.
6. 600 lb. hay
    300 lb. corn
7. $17.07
8. $7.02

III. Succulent Feeds

1. $59.85
2. About 14 lb. alfalfa
    About 42 lb. silage
3. $18\frac{3}{4}$ cents
4. 678 lb. linseed meal
    906 lb. cottonseed meal
    500 lb. gluten meal

5. 27 cents cheaper in clover
6. Cottonseed meal by $1\frac{2}{5}$ cents
7. 8 cents per pound in bran
10 cents per pound in oats
8. $6\frac{2}{5}$ cents; cheaper in alfalfa by $1\frac{3}{10}$ cents per pound
9. 11.4 cents per day

Silos — Page 81

1. 31.416 ft.
2. 78.54 sq. ft.
3. 8 ft. nearly
4. $205\frac{5}{7}$ days
5. $1\frac{2}{3}$ acres
6. 54 tons
7. $\frac{5}{6}$ cu. ft.
8. 5 sq. ft.
9. 8 ft.
10. 10 ft.+
11. 180 days
12. 13 ft. diameter
30 ft. height
13. 48 tons
14. 50 cu. ft.
15. $52.20; $147
16. $13.80

Planting Problems — Page 85

1. 6 rows; 36 rows
2. 141 rows
3. 6 sq. ft.
4. 1200 sq. ft.
5. 1815 plants
6. 18,150 plants
7. Answers will differ
8. 53,338 hills
9. $5\frac{1}{5}$ bu., nearly
10. $12\frac{1}{2}$ acres
11. $3\frac{3}{8}$ acres
12. $72
13. Answers will differ

A Trucker's Problems — Page 88

1. $41.48
2. $5.18
3. $340.48; $4\frac{1}{10}$ cents
4. Answers will differ
5. $37.50
6. 75 cents
7. About 12 sq. ft. to each plant; 3 ft.
8. $72.60
9. $285.88
10. $\frac{2}{3}$ acre
11. $\frac{2}{3}$ acre, beans
$\frac{1}{5}$ acre (nearly), beets
$\frac{1}{8}$ acre (nearly), eggplants
$\frac{2}{3}$ acre (nearly), sweet corn
12. Answers will differ

An Acre of Potatoes — Page 91

1. 14,520
2. $60\frac{1}{2}$ bu.
3. $30\frac{1}{4}$ bu.; $15\frac{1}{8}$ bu.
4. 13 bu., nearly
5. Wholes; wholes; halves
6. 13 bu.; 4 bu.
7. 104.4 bu.; 4 bu.
8. 217.80 bu.; 300.6 bu.
9. $36.50
10. 121 bu.
11. $4 loss
12. 35%; 65%

Fertilizers — Page 95

1. 311.4 lb. ammonia
172.8 lb. phosphoric acid
63 lb. potash

2. 49.7 lb. ammonia
20.4 lb. phosphoric acid
12 lb. potash

3. 91.1 lb. ammonia
37.5 lb. phosphoric acid
22.1 lb. potash

4. 24.8 lb. ammonia
11.7 lb. phosphoric acid
17.5 lb. potash

5. $5.34

6. Answers will differ

7. 360 lb.

8. 125 lb.

9. 140 lb.; 560 lb.

10. 60 lb. ammonia
120 lb. phosphoric acid
160 lb. potash

11.

Ammonia	Phosphoric Acid	Potash
40 lb.	160 lb.	200 lb.
20 lb.	160 lb.	20 lb.
40 lb.	120 lb.	80 lb.

12. 4 lb. ammonia
16 lb. phosphoric acid
4 lb. potash

13.

Ammonia	Phosphoric Acid	Potash
20 lb.	160 lb.	40 lb.
40 lb.	160 lb.	60 lb.
80 lb.	140 lb.	200 lb.

14. $32.40

15. 72 lb. ammonia
196 lb. phosphoric acid
100 lb. potash

16. 320 lb. sulphate of ammonia
1143 lb. phosphoric acid
160 lb. muriate of potash

17. 222 lb. nitrate of soda
571 lb. acid phosphate
320 lb. kainit

18. $18 **19.** $31 **20.** $10 **21.** $60 **22.** $8

23. $10\frac{5}{12}$ cents **24.** $7\frac{1}{2}$ cents

25. The 30-dollar fertilizer, by $23\frac{1}{2}$ cents to every dollar's worth

26. The 30-dollar grade, by $4\frac{1}{6}$ cents to every dollar's worth

27. No, only $1.00 **28.** No **29.** $15.50 **30.** No; $4.50 loss

Farmyard Manures — Page 105

1. $2.25 **2.** $315 **3.** $189

4. Answers will differ **5.** 49%; 48.9%; 38.9%

6. $4\frac{2}{5}$ months **7.** 8 tons **8.** $18.76

9. $17.31 **10.** $11.31 **11.** $21.12

Spraying — Page 110

1. About $1.44
2. About $10
3. $22\frac{2}{9}$ bu.
4. 28 cents
5. 92.1%
6. About 50%
7. $10.75
8. 200%
9. $3
10. 49 cents
11. $46

Drainage — Page 118

1. 3 inches
2. $40.15
3. 2.6 years
4. 3 ft. 4 in.
5. 300 ft.
6. $96 ; $108.80
7. $2.50 cheaper by the rod
8. $6
9. $8.72
10. $17.42
11. About $\frac{2}{3}$
12. $1\frac{7}{9}$ times
13. Answers will differ

A Normal Day's Work — Page 121

1. $22.50
2. 4.4 days
3. $10.95
4. 1.7 days
5. 2.1 days
6. $1
7. 8.1 days
8. 193.86 bu.
9. 39 bu.

What a Boy Can Do on His Club Acre — Page 125

1. $282\frac{8}{29}$%
2. $35\frac{1}{3}$ cents
3. $8\frac{2}{3}$ cents
4. 66.86 bu. per acre

What a Girl Can Do in Her Cannery — Page 128

1. $9.20

Farm Finance — Page 130

1. $41.56
2. $14.62
3. $42.75
4. $162.44
5. $251.25
6. 38 cents
7. Cash plan, by $3.39
8. $138.72
9. $7\frac{9}{13}$%
10. Answers will differ
11. Answers will differ
12. $139.20
13. Discount plan, by 1 cent
14. $27.40

Labor Problems — Page 133

1. $39
2. $6
3. The former, by $2.50
4. Jim will earn $3 more
5. The latter plan, by $1.14
6. $16.50
7. The former plan, by $3
8. The latter, by $1
9. $111.16
10. $35.55
11. $1.98

Six Ways for a Farmer Boy to Make Money — Page 135

1. Capital $5.85; net receipts $3.70
2. $24.18 **3.** $10.08 **4.** $2.50
5. $14 **6.** $35.39

Six Ways for a Farm Girl to Make Money — Page 137

1. 20% **2.** $12.87 **3.** 28 cents; $127\frac{3}{11}$%
4. $9.12 **5.** $21.31 **6.** $1.14

Labor Income — Page 139

1. $500 **2.** $200
3. $210 more the first year **4.** $814; $414
5. $1310; $710; $1110 **6.** $120; $1120; $1000

Farm Credit — Page 142

1. $1950 **2.** 90 cents; $4.80 **3.** 0
4. $8\frac{1}{3}$ years; $20; $240
5. 5 years **6.** $150 **7.** $250
8. $19; 18%, nearly **9.** $29; 28%, nearly **10.** $1060
11. $270

Animal Units — Page 147

1. $\frac{1}{2}$; $1\frac{1}{2}$; $\frac{1}{5}$; $2\frac{2}{5}$; 4; $\frac{3}{7}$; 2 **2.** $21\frac{2}{7}$ animal units
3. About $5\frac{1}{6}$ acres **4.** Answers will differ
5. The former

Farm Economics — Page 149

Relation of Farm Size to Man Labor

1. 20 acres of man labor **2.** 180 acres
3. About $3\frac{1}{2}$ times **4.** 40 acres
5. 50%

Relation of Farm Size to Horse Labor

1. 4.8 crop acres **2.** 90 acres
3. About 2 times as much **4.** 30 acres
5. The product of 1 acre in the Mid-west
6. Nearly 2 men; 4 horses

Relation of Farm Size to Value of Machinery

1. $71 **2.** $2.34 **3.** $1 **4.** $2 **5.** $1.60; 80 cents

Relation of Yield to Profits

1. $ 8.75
2. $ 1.25 loss on the increase
3. The latter, by $ 70
4. Market price, less
   Cost of handling, greater

Relation of Cow Receipts to Profits

1. 6000 lb.
2. $ 4 per cow loss
3. $ 21 per cow
4. The potatoes, by $ 18 per acre

Miscellaneous Problems — Page 157

1. 20 %
2. 20 %
3. 13⅓ bu.
4. 23¾ %
5. Answers will differ
6. 40 % ; 20 % loss
7. 1 man to 20 crop acres
8. $ 164
9. 16⅔ acres
10. $ 1611
11. $ 1849.50

Relation of Capital to Profits — Page 160

1. $ 1938 ; $ 1530 ; $ 408
2. $ 992 ; $ 121.55 ; $ 870.45
3. $ 150 ; $ 81
4. $ 150 ; $ 1282
5. $ 750 ; $ 2250
6. $ 353.70 ; $ 414
7. $ 461.65 ; $ 665 ; $ 1012.60
8. 3.7 %
9. $ 300 ; – $ 450 ; $ 300
10. First year, by $ 120

Problems in the Dairy — Page 164

1. About 13 lb.
2. About 1½ miles
3. 14 cents, or 14 %
4. 40 cents
5. In Iowa, by 11 cents
6. 18 cows
7. Large cows, by 314 lb.
8. Small cows, by $ 215.26
9. Large cows, by $ 268.74
10. $ 50.50
11. 10 cents

Feeding Problems — Page 167

1. $ 17.47
2. 30 bu.
3. 225 lb.
4. 1400 lb.
5. In Iowa, by $ 4.80
6. $ 80
7. 26⅔ %
8. $ 12

Machinery and Depreciation — Page 169

1. 15 years, nearly
2. $ 6
3. 11⅕ acres
4. $ 4.87
5. 68⅕ cents
6. 33⅓ cents
7. $ 15
8. $ 60

Miscellaneous Problems — Page 172

2. $142.50
3. Expense about the same; income twice as much
4. 15%, nearly **5.** $27
6. $4.12 gained by retailing **7.** 6 cents cheaper at home
8. About 6 cents more **9.** $15.50
10. 27 trees

Home Economics — Page 176

1. Answers will differ **2.** Answers will differ
3. Answers will differ **4.** 10 cents; 20%
5. Answers will differ **6.** $14\frac{29}{50}$ tons
7. 64% **8.** 16 cents **9.** $44\frac{4}{9}$%; $55\frac{5}{9}$%
10. $9.25 **11.** 277.7 times
12. Dollar shirts, by 25 cents **13.** 16-dollar suit cheaper by $4
14. $46\frac{1}{2}$%; 20%
15. 36 cents porterhouse; $31\frac{1}{2}$ cents round; 30 cents chuck rib

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6. Answers will differ
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